EDITORIAL

A FEW months ago I wrote an article for this magazine concerning Amateur Radio in which I had some strong criticisms to make of the wasted frequencies on the bands devoted to High Frequency broadcasting.

Since then I have found almost universal agreement with what I had to say. It could scarcely be otherwise, for the multiplicity of services which continue to pour into the ether like an avalanche, and the prodigal waste which results from indiscriminate jamming, makes a clean up of the bands a matter of highest priority.

Here, at the ITU Conference in Geneva, HF broadcasting has emerged as the hottest bone of all contentions. With fixed channel users also clamouring for more frequencies between 4 and 27.5 megacycles, this section looked ready to be torn to pieces.

So great were the dangers of hopeless disagreement, which could have resulted in remaking this section, that major conference opinion favoured no changes at all, rather than to undertake any but minor adjustments.

And a special committee with limited but representative membership was set up to make recommendations on this point. So far these are not available.

The position is that although engineers all agree that HF broadcasting is quite out of hand, they are obliged to seek more space under direction of their governments who are determined to have more outlets. Naturally some countries are more interested than others, and one can understand the plight of new and small nations who really need non-existent channels for their own purposes.

The solution appears to be not so much a matter of band expansion as of better band management. Time and again this opinion has been expressed at this conference. Otherwise countries without what they consider adequate assignments will operate out-of-band and have already commenced to do so.

If this continues, the whole HF spectrum is in danger, every type of service will suffer interference and damage, and we will have a hopeless pile-up.

John Moyle

RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION HOBBIES AND POPULAR SCIENCE

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OUR COVER PICTURE

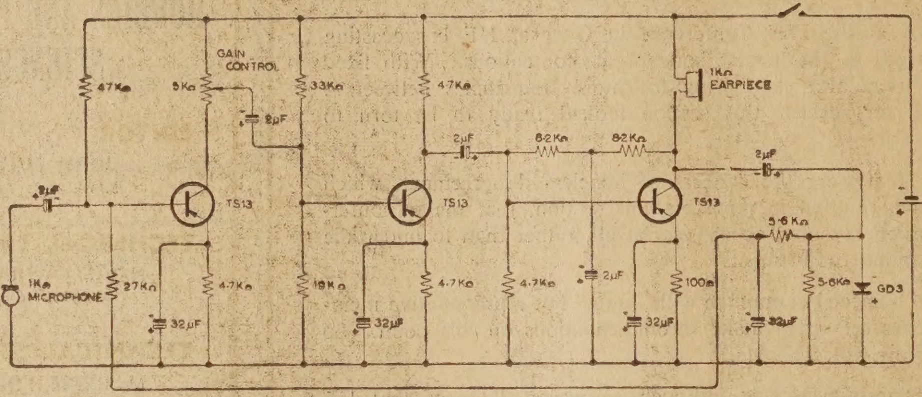
This F-104-9 version of the Lockheed "Starfighter" is externally identical to the U.S. Air Force model but omits some of its internal accessories in the interests of economy and simplicity of maintenance. Powered by a G.E. J79 turbojet, speed is 1400mph and altitude crown better than 90,000ft.

INDEX

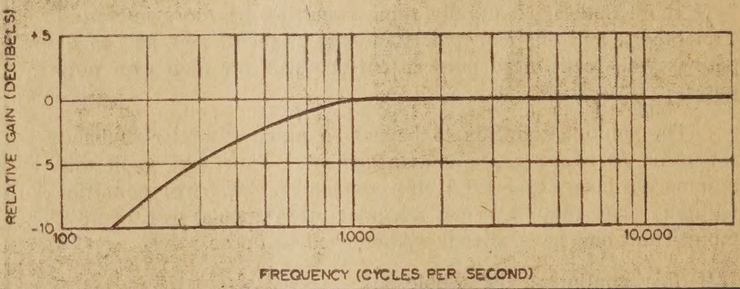
Page
New Giant Telescope In Service . 3
Cars Without Wheels 4
Power For Men On The Moon .. 9
From The Editor—In Europe 13
Do Migrating Birds Fly By The Stars? 16
Technical Review 21
News And Views Of The Month .. 29
Multi-Purpose Record Player 32
rom The Serviceman Who Tells .. 41
ransporta Four 48
How To Learn The Morse Code .. 57

Page
The 1959 TV Set—Part 3 64
Here's Your Answer Tom! 77
Rectifiers Becoming Smaller 81
A Reader Built It 87
One TV Aerial—Several Sets? 89
Trade Reviews And Releases 93
Let's Buy An Argument 96
Off The Record—News And Releases 101
Technical Book Review 111
Short Wave Notes 112
The Amateur Bands 113
Answers To Correspondents 125

SETS THE STANDARD FOR TRANSISTORS



TRANSISTOR HEARING AID UNIT



The circuit diagram above shows a transistor hearing aid unit capable of very good performance, although of simple design.

It is intended for use with an earpiece and microphone of the magnetic type, both of which are readily available. The absence of iron-cored transformers enables the unit to be of very small physical size.

The voltage gain is approximately 45 dB. with a supply voltage of 1.5 volts, which is generally adequate; it can be increased to approximately 54 dB. by using a supply of 3 volts. The current drain at 1.5 volts is 3.5 milliamperes. If even greater gain is required, an additional transistor can be added.

The frequency response of the amplifier itself is shown in the accompanying curve; the response of the entire unit will depend also upon the characteristics of the microphone and earpiece.

The audio frequency output voltage is rectified by means of a germanium diode, filtered and applied to the base of the first transistor to operate as an automatic gain control system.

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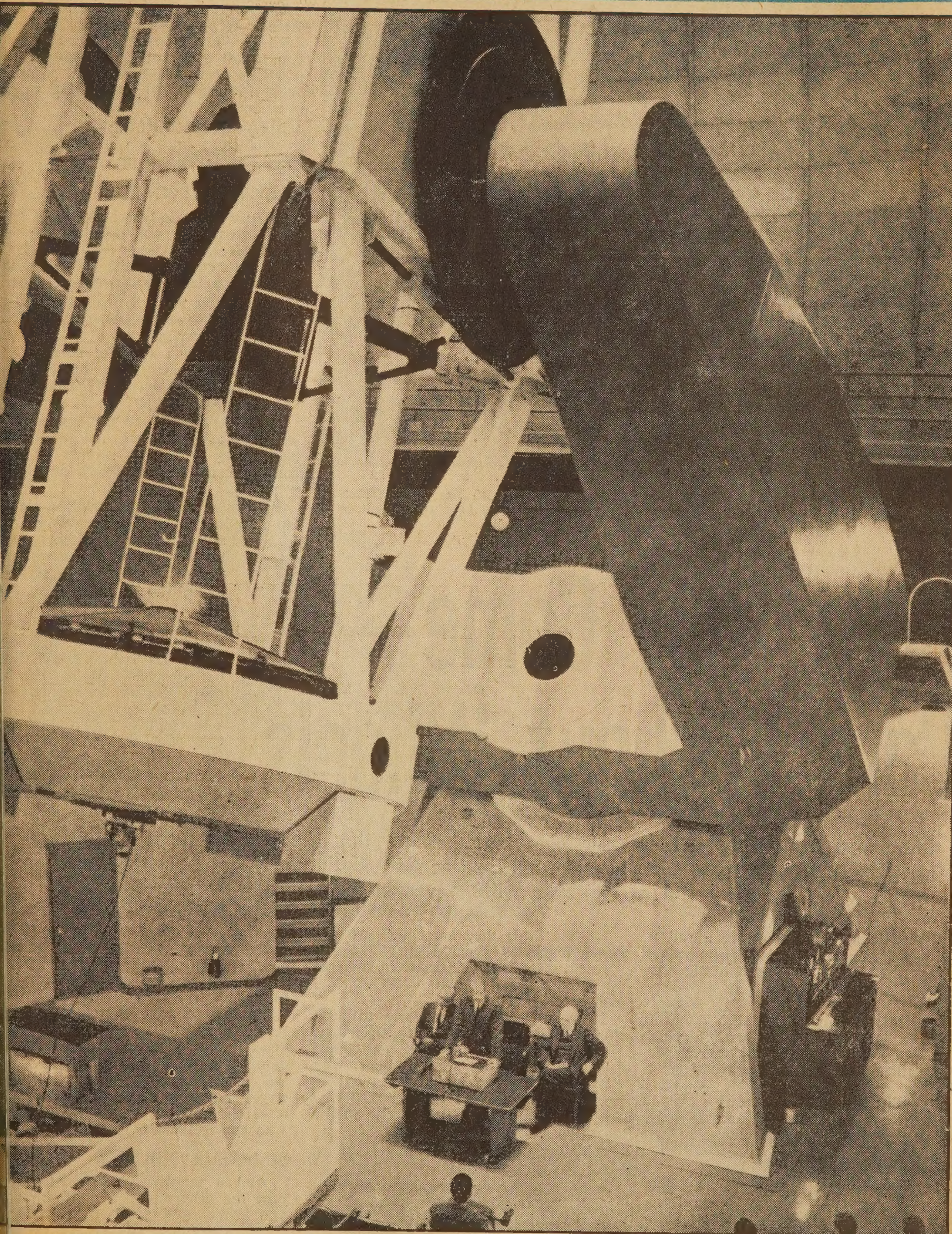
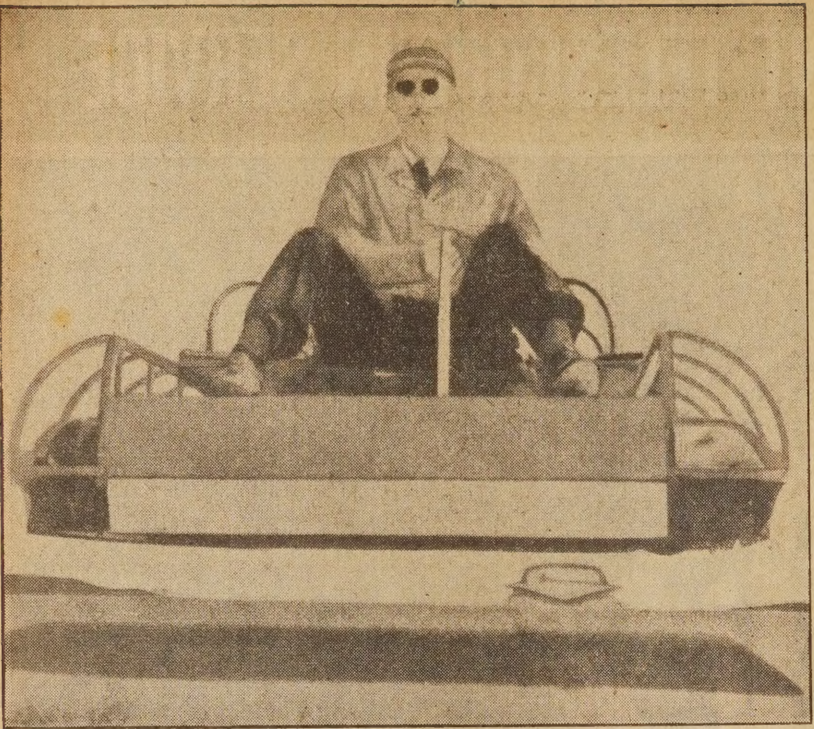
M182

A NEW GIANT TELESCOPE IN SERVICE



xceeded in size only by the huge Mount Palomar installation, this new 120-inch telescope has recently een dedicated at the Mount Lick Observatory, associated with the University of California. The huge mechanism dwarfed speakers at the ceremony.



Forerunner of what might easily become a new craze, a "car" like this, without wheels, has already been built by a U.S. country doctor, who likes to dabble in engineering between professional calls.

Here They Come— Cars Without Wheels

Imagine a car without wheels, skimming four feet off the ground across roadless terrain. Imagine a ship carrying ocean-liner loads continent-to-continent with steamship economy but gliding above the waves at 150 m.p.h.

IMAGINE a train, following a rail it never touches, beating airline time New York to Boston, Chicago to Detroit, or San Francisco to Los Angeles.

The first test models of such fantastic vehicles have already "flown." (They don't really fly because they never get more than a few feet up.) Several more will be skittering across fields and bays before the U.S. summer is out.

These are not table-top research toys, but big man-carrying vehicles.

SLIDE ON AIR

What are they? Air sleds. They slide on compressed air blasted down by a propeller. This air cushion holds them up the way a fountain supports a ball bobbing in its water jet. Freed from friction with the ground or water underneath, they can zoom forward at airplane-like speeds—or so their proponents say!

(In the trade they are called ground-effect machines because they use the "ground effect"—the increase in lift that an aircraft gets when close to the ground.)

Some use two engines: one to push down for support, another to push back for propulsion. Others move on a single engine by dividing its air blast with ducts. Still others unbalance the supporting cushion (with dampers) so that the sled keeps "falling downhill" in the direction you want to go.

They really work. It sounds crazy, all right. But I have seen these air sled with my own eyes. I rode one, an tried my hand at piloting another.

By Martin Mann

They threaten to turn transportatio inside-out, giving you a sports ca speedboat, half-ton truck and back-pac helicopter all rolled into one.

Those working on them claim tha there is no practical restriction on speed Even a puny beat-up old engine get you to 60 miles an hour easily. Th drafting-board doodlers are thinkin about 150 m.p.h. over water, 500 m.p.h over land.

But you could go faster—or as slowl as you want, since it's not the forwar speed that keeps you up.

TRAVEL ANYWHERE?

The air sled can travel anywhere, the say, across land, sea, marsh, snow, ic or whatever. It doesn't need a road. will settle down or take off from an more-or-less level spot you find.

And the big thing: It should be chea You get a lot of load-carrying capacit for a small expenditure of horsepowe Compared with a ship the same size, large sled should transport the same ton nage the same distance for the same co —but five times faster!

A breakthrough like this could shak up living patterns here and everywher else. Any stream or stretch of ope country becomes a highway, any beac a harbour.

Fishermen and hunters will be able zip into locations that are now practically inaccessible. Lonely far families will get to town, wi ter and summer, as easily as they lived alongside the fre way.

Commercially, the dee water harbours that are gre port cities' richest assets woul be obsolete. Wide beache gently sloping, are nature's ow docks for big freighter air sled The centres of trade mig shift from New York and Ne Orleans to the sand flats Long Island and Florida.

The military implications a clear. A few sleds will float a divisi across oceans right to a battlefront no hazardous landings in the su Smaller types will provide ideal pl forms to carry scouts, supplies, artille

No wonder the Navy, Army, Force and National Aeronautics Space Administration are plough money into air-raft development. T are building actual vehicles, which secret, as well as sponsoring fundame research, which is wide open to any who can follow the maths.

AMATEUR BUILDERS

And a number of outsiders is ning the government a good race, s you don't need much more than wood, aluminium and an old petrol gine to start with.

On the very day that Congressme Washington gaped at a demonstratio small lab models, "Popular Scien Bill Morris and Bob Borst were ph graphing a big man-carrying machine in the corn-and-hog town of Neponset, Il (pop. 500).

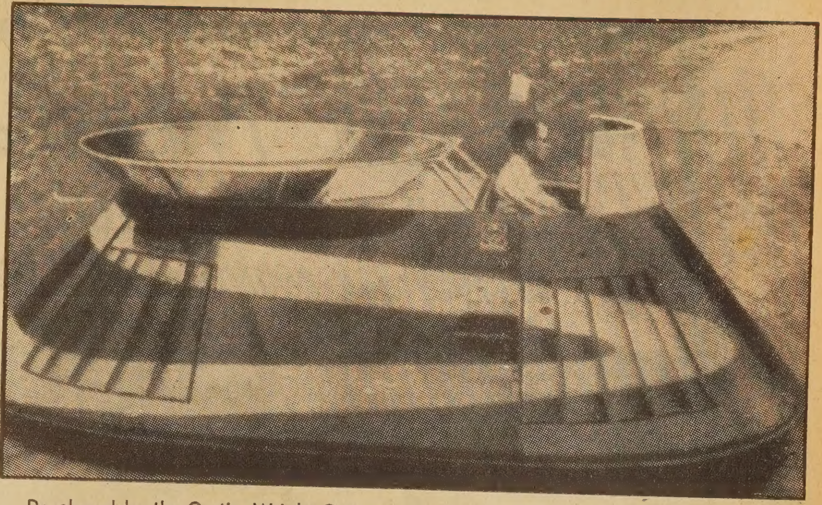
It was built in the back of an old feed store by lanky, sandy-haired physician-inventor-engineer William R. Bertelson. The doc used his own money, the expert craftsmanship of his friends and neighbours, and whatever time was left over from delivering babies.

SPEED OF 60 m.p.h.

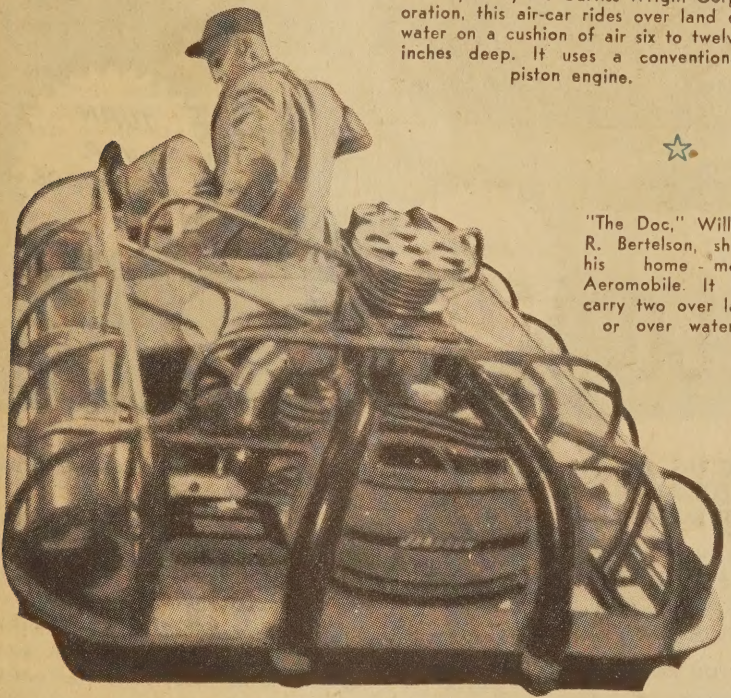
Then there's Walter Crowley, a strictly independent designer, who rocked military brass last winter by flitting around a Washington golf course at 60 m.p.h. in his haywire rig. His company, Spacetronics, Inc., plans to make more substantial versions for the rich-fisherman trade in Florida.

Over in Switzerland, Carl Weiland will “launch” a 33ft four-seater on the lake at Zurich later this summer.

In Britain, Saunders-Roe (the airplane makers) are now test-flying the SR-N1 Hovercraft, a 30ft, 450 h.p. two-seater, before starting on commercial channel ferries.



Developed by the Curtiss Wright Corporation, this air-car rides over land or water on a cushion of air six to twelve inches deep. It uses a conventional piston engine.



"The Doc," William R. Bertelson, shows his home-made Aeromobile. It can carry two over land or over water.

And back in old Dearborn, Ford otor glided a secretary down the Re-arch Lab corridor on a dingus that the ess agents call a Levascooter, and owed off a model of a 500 m.p.h. jet-opelled “Glideair” vehicle.

What holds them up? The idea of ating solid objects by blowing air under m is an old one, used for many years frictionless bearings.

Airplane gyrocompasses have them; so es one kind of fixture table for hold work on a machine tool. But the st familiar example is the Hoover nstellation vacuum cleaner. It blows aust air out underneath the canister, the canister actually floats, friction-, off the floor (you can see the gap ou look closely). A gentle tug on the ner's hose glides the heavy canister t across a rug.

ll the air sleds use this air-bearing principle, but boost it up to support loads incredibly heavier than vacuum cleaners.

The Ford version is the simplest. The vehicle has flat pads underneath, each with high-pressure air whistling out a hole in its centre. This creates a thin film of pressurised air under the pads, enough to hold the vehicle up off the surface.

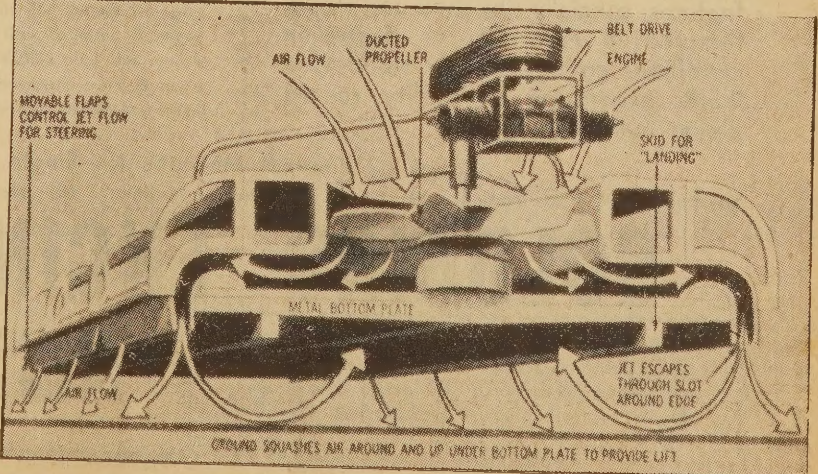
SMOOTH SURFACE

But—to support reasonable loads with reasonable air supplies, the clearance between pads and surface must be very small, around .025in. That means the surface has to be very smooth—a rail.

And this is the idea that Ford's engineering v-p, Andrew Kucher, is pushing: a jet-propelled train. It would ride on a thin film of air underneath pads that fit around a standard rail.

The Spacetronics machine gets off the rail by feeding the compressed air to one big hollow chamber—the vehicle is like an inverted cup. This gets a lot

This diagram illustrates the operation of "The Doc's" Aeromobile. An aero-type propeller pushes air down into the chamber underneath and hence out through slots at the edges. Escaping air jets squash against ground to form a supporting air cushion. Flaps steer machine by adjusting flow of air.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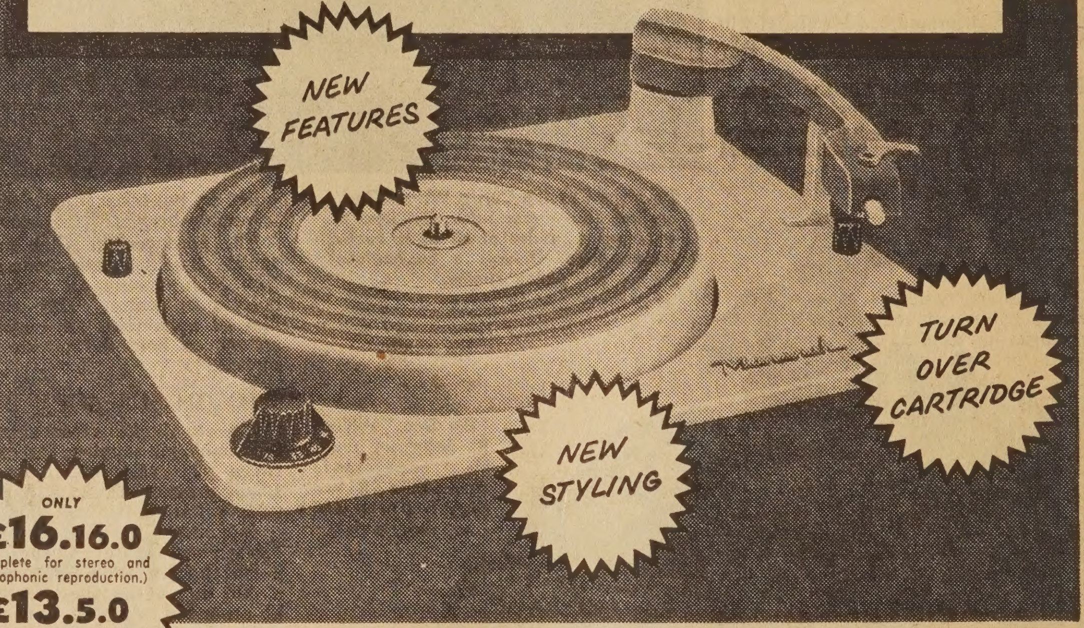

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more lift—6in or so, enough to ride over fields or water. But it takes a tremendous volume of air—somewhere around a million cubic feet per minute—to support a 25ft raft.

Weiland's idea is more involved. He plans a series of grooves underneath his sleds, with propellers inside each groove pumping air up to be bounced down again. This way most of the air is trapped underneath the sled, continuously being recirculated, and not much leaks out past the edge of the sled.

BIG SLED

Weiland's "labyrinth" air traps should work best with a big sled (the air-escape area at the edge is then small compared with the volume of air trapped in the cushion), and his proposal is a big one, a 330ft, 1,000-passenger ocean liner. It would cruise 35ft high — well out of reach of waves—at 100 knots!

The Illinois physician, Dr Bertelson, is working still another angle. His sled has a smooth bottom with slots for air jets at the edges. The air then comes out in a flaring stream, lily-shaped. When the air stream hits the ground, part is bent around and back up underneath, supporting the sled.

This edge-jet design is the one favoured by government engineers. Reason: t promises to lift hundreds of pounds f load for every pound of thrust expended by the air jets. (For comparison he Boeing 707 jetliner carries about 5lb or each pound of thrust.)

PIONEER WORK

Credit for pioneering research on this ind of jet goes to Uwe von Glahn, of he National Aeronautics and Space Administration. His static-test data are reied on by most sled builders. Von Glahn lidn't invent the edge jet, however, and t's not at all clear who did. (The basic atent, if there were one, would be worth nillions.)

What's wrong with them? You can uild a working model of an air sled ourself with a model-airplane engine nd a child's snow coaster. It will fly eautifully across your lawn.

So why hasn't the Navy ordered a eet of big ones? Beyond the millions f technical problems that stand between e working model and the usable achine, a couple of stoppers worry ngineers:

OSSIBLE OBJECTIONS

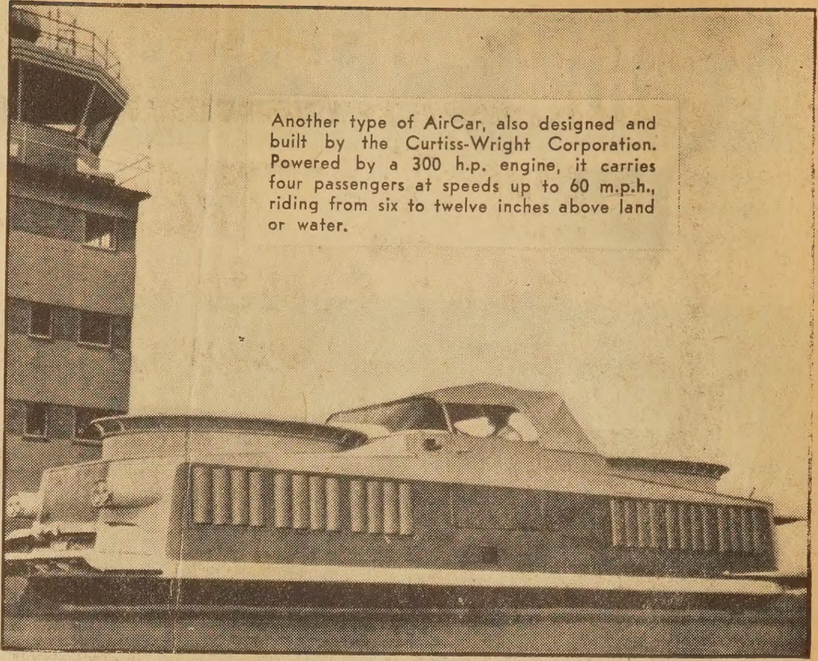
Forward speed of the sled may blow s supporting air cushion right out from nder it, and the thing won't stay up. owever, Dr Gabriel Boehler, Catholic niversity's young professor of aeronaual engineering, who is analysing aird theory for the Navy, ran a model a wind tunnel at 40 m.p.h. with no uble, and thinks that, one way or aner, the cushion can be maintained.

Dust raised by the air jets may cause uble over land, and spray over water.

Hills, surprisingly enough, could stop air sleds dead. The Spacetronics chine, for example, had trouble stay- on a crowned road—it kept sliding into the ditch. Dr Bertelson's mach- couldn't climb all the way up the ch after gliding across a pond. The son: The air cushion holds the sled parallel to the ground. If the ground is not level, gravity makes it slide, just as gravity makes you slide down an icy hill.

The objections are mainly theoretical, so far, and may stay that way. This summer's trials will tell. As one inventor, miffed at missing a fat government contract, said:

"We know we can build a machine that works even if those Ph.D. aerodynamicists can't figure out why it works."



Another type of AirCar, also designed and built by the Curtiss-Wright Corporation. Powered by a 300 h.p. engine, it carries four passengers at speeds up to 60 m.p.h., riding from six to twelve inches above land or water.

HOW THICK ARE CYLINDER WALLS?

For improving quality control of automotive engine castings, General Motors Process Development Staff has designed an ultrasonic gauge that simplifies measuring thousandths of an inch variations in cylinder wall thickness.

THIS non-destructive tester also can be adapted to measure thickness of straight or curved surfaces of cast iron, steel, aluminium, magnesium, brass, lead, glass and most solid plastics, with only one side of the material accessible.

According to Robert B. Colten, head of Process Development Staff's Electronics Department, the device utilises the principle of ultrasonic resonance. In effect this means a probing crystal is vibrated against the inside cylinder wall surface, sweeping as high as 4 million cycles per second, until at some frequency point the surface is vibrating in harmony with the crystal.

At this point the wall thickness and the crystal are in resonance. This resonance will vary with the wall's thickness. Thus, it can be used to give an indication of the thickness.

This new tester differs from other resonance frequency devices with its easy-to-read 14in oscilloscope tube on which an 11in scale is calibrated for thickness variations as low as one-thousandth of an inch. Cylinder wall thickness is indicated by a single, vertical step in a bright horizontal line rather than by two or more vertical "pips" which occasionally need expert interpretation.

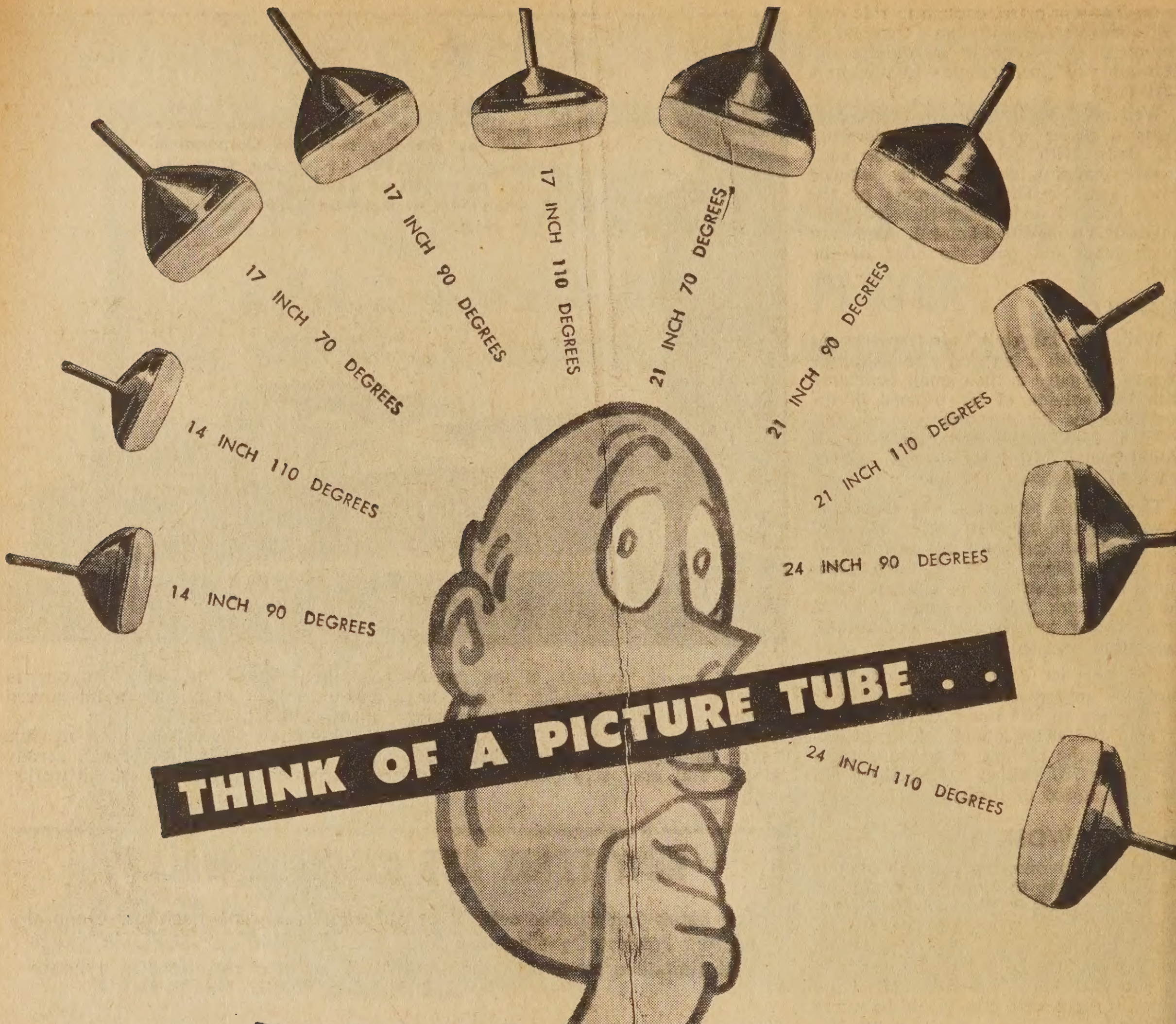
Thus, the PDS tester requires no specially trained operator. When it "decides" **cylinder wall thickness is sub**standard or too thin, a red low-limit light flashes on. Mr Colten said it also is possible to replace the warning light with other devices for automatically marking or segregating substandard parts under test.

The gauge was developed at the request of G.M.'s automotive divisions for improved quality control of engine castings. Sometimes in the casting process a core shift will occur. This affects the critical thickness of cylinder walls.

Wall thickness gauging can also be done by magnetic methods, but their accuracy may be influenced by varying magnetic properties of metals under test. Thus, the ultrasonic resonance technique was suggested and augmented by circuitry for the easy-to-read TV-like viewing screen.

The gauging unit is housed in a portable cabinet (27 x 14½ x 17in), which can be set up in any shop or assembly plant.

A typical thickness range for cast iron is .075 of an inch to .300 of an inch. Other ranges can be provided to give thickness measurements of materials ranging from .075 to 1in thick, depending on the kind of material being measured. Overall accuracy is within 2 per cent of full-scale reading, but this percentage can be reduced for special applications.


17 INCH 70 DEGREES
17 INCH 90 DEGREES
17 INCH 110 DEGREES
21 INCH 70 DEGREES
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POWER FOR MEN ON THE MOON?

It is one thing to land scientific equipment and even men on the moon. It is quite another to provide it—or them—with a continuing source of electric power. This article examines possible sources of power, including the hydrox fuel cell, which is currently very much in the news.

By Walter F. Hiltner and Henry Oman *

ALL the astronomical information collected through the centuries could e made out of date in a single month f observations from a station on the noon, if the people on the moon had dequate equipment—and electric power o make it run.

Without such power, their equipment night be useless, their stay of hours or veeks most difficult, and the value of heir hazardous adventure into space essened by inability to transmit back to arth some idea of the things they saw nd learned.

Such a moon visitation may still be ears away, but the problem of how to upply electric power—whether for telecopes or to operate radios—must be olved well before the trip.

Once the exclusive domain of fiction writers and their artists, the moon and its occupancy are rapidly becoming matters of immediate engineering import.

ROBLEM OF POWER

Just how can a station on the moon et electricity?

A few problems are obvious: the supying device must be small enough to ansport on space vehicles; it must erate without a generous supply of air asoline engines won't run in a vacuum); must be cheap enough to be within e means of the nation which sends a oon crew aloft — although it's quite ssible that any of the equipment taken such an expedition might cost more r pound, in its final location, than the ice of pure gold.

An unmanned moon station might nd back to earth feeble radio signals r a time with only battery power, but is is limited in duration and strength.

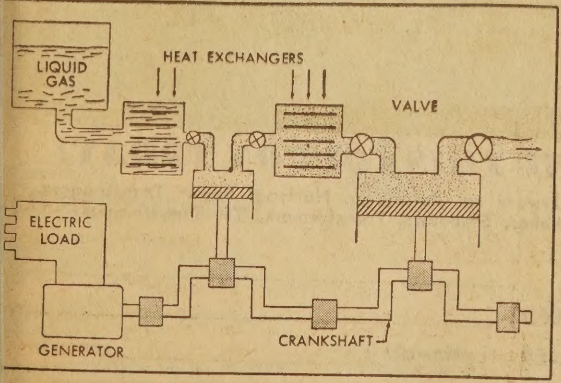
For manned stations, the .practical ergy sources appear to be gas expann engines, fuel cells, solar devices, d nuclear fusion.

A gas expansion engine utilising exnding gas to turn a piston engine or bine which drives an electric generator — is not particularly efficient on earth but presents opportunities in a vacuum.

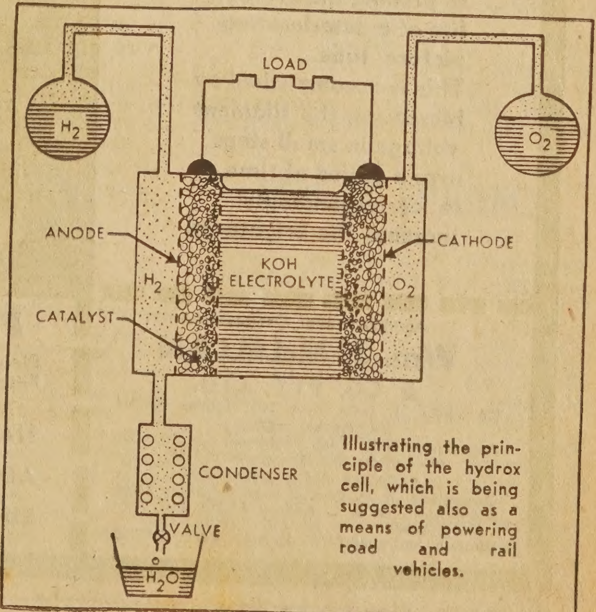
In this system, liquefied gas might be transported to the moon. In one heat-exchanger, it could absorb enough heat from the closed lunar station to vaporise the gas and raise it to zero centigrade, after which it could be admitted to the first stage of a piston engine.

The engine could drive a generator to produce electricity for radios, lights, and local transportation. This energy ends up as heat, which can re-heat the gas for further expansion.

This process could be continued in-



transporting liquefied gas to the moon and allowing it to pand through a gas-piston engine, power could readily be generated.

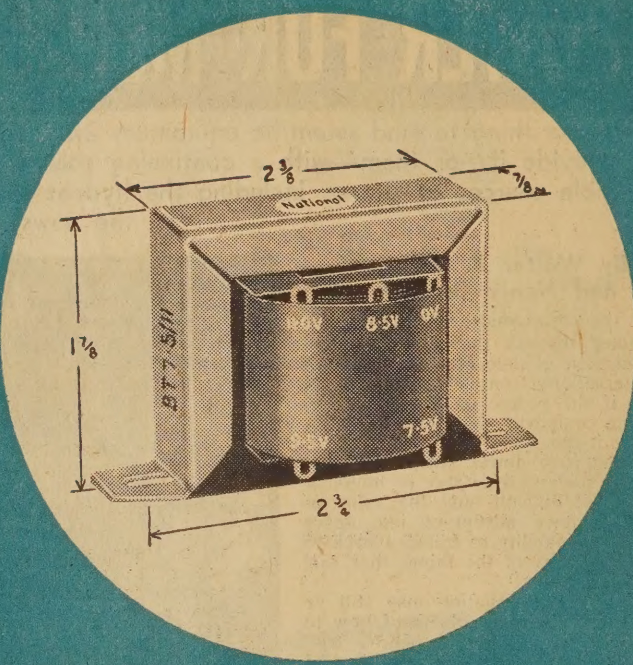


Illustrating the principle of the hydrox cell, which is being suggested also as a means of powering road and rail vehicles.

Boeing Systems Management Office

Extend the life of your picture tube

with a . . .



National BOOSTER TRANSFORMER

National Booster Transformers are designed specifically to prolong the useful life of a deteriorating picture tube. This is accomplished by increasing the filament voltage in small steps over a period of time to correspondingly increase the brightness.

TYPE BT7.5/11 or TYPE ABT7.5/11

TYPE BT7.5/11 is a double wound transformer which does not draw current from the main transformer and consequently does not overload it.

Characteristics
Primary—240V.
Secondary—7.5V, 8.5V, 9.5V, 11V at 1A.
Size—as illustration.

TYPE ABT7.5/11 is an auto transformer using a nylon bobbin. This transformer is mounted externally and can be easily connected without removing the chassis. As the transformer is wired direct to the 6.3V picture tube filament line there is no danger of mains voltage.

Characteristics
Tapped at 6.3V, 7.5V, 8.5V, 9.5V, 11V at 1A.
Size—as illustration.

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definitely — or as long as larger and larger cylinders were available.

The pressure ratio available is infinite in a vacuum, hence infinite energy is theoretically available from a pound of gas. In practical engines it appears that specific propellant consumption ratios of better than one pound per kilowatt hour are hard to achieve.

A fuel cell converts the chemical energy of hydrogen and oxygen into electricity and has an efficiency of 60 to 80 per cent, with the additional advantage of creating water — another essential to life on the moon.

HYDROGEN, OXYGEN

In the fuel cell, hydrogen and oxygen are admitted to porous electrodes of carbon or sintered nickel, resulting in a current flow in an external circuit and creation of water in the hydrogen space.

Specific fuel consumption, as in the gas expansion engine, is about one pound per kilowatt hour of power.

Solar energy — made usable through conversion into electricity by photovoltaic devices such as silicon solar cells — may be the first practical energy source for long stays on the moon, since ts fuel consumption is virtually zero.

The only things to be considered are he size and the costs: a minimum of 00 pounds and 30,000 dollars per kilowatt of output.

Perhaps much lighter units to use the power of the sun could be built, but the principal problem is that night on the moon lasts for 354 hours. Hence, some method of storing power for that time is essential.

A battery which could store 354 kilowatt hours might weigh three and a alf tons.

Energy storage might be accomplished y producing hydrogen and oxygen hrough electrolysis of waste water, then permitting the oxygen to radiate its heat to space (thus producing liquid oxygen) and compressing hydrogen in empty rocket-fuel tanks from the moon transport vehicles.

The hydrogen and oxygen then can be used in fuel cells to generate power during the long night.

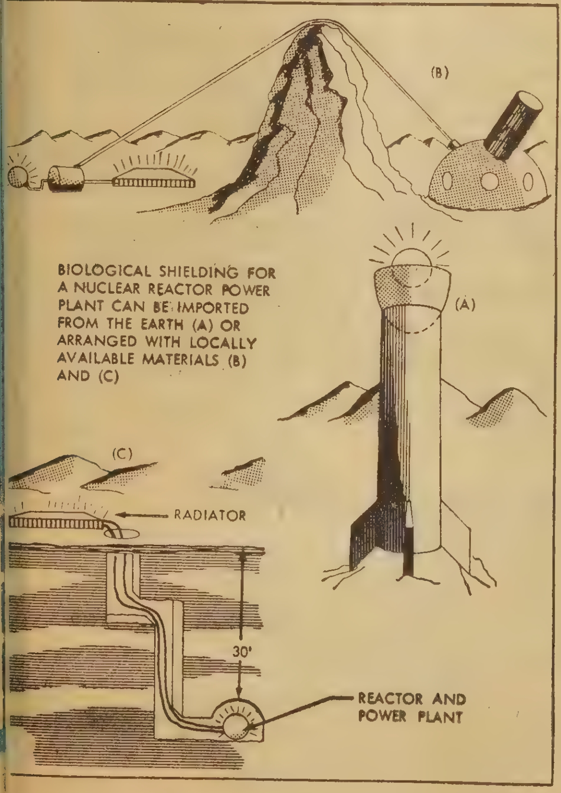
However, there is no need for energy storage if nuclear power is used. The great problem is shielding the reactor, especially in the probable absence of hydrogen or other low weight atomic materials on the moon.

A 10-kilowatt nuclear power plant might weigh only 750lb, but the necessary shields, if brought from the earth, might weigh many times that much. The estimated cost of a nuclear power unit of this sort is something like 30-million dollars.

Conclusions cannot be reached this early, but it now appears that a combination of methods—batteries for unmanned lunar probes, fuel cells for the first manned moon stations, and solar or nuclear power for later, more permanent men on the moon — may solve this problem.

The correct solutions may determine, in the end, whether a visitor to the moon really can accomplish anything important for the millions of people who only look at the night sky and wonder.

☆



BIOLOGICAL SHIELDING FOR A NUCLEAR REACTOR POWER PLANT CAN BE IMPORTED FROM THE EARTH (A) OR ARRANGED WITH LOCALLY AVAILABLE MATERIALS (B) AND (C)

Nuclear energy appears to offer a very practical source of power for activities on the moon. To avoid the need to transport heavy shielding, advantage would have to be taken of natural obstacles of man-made tunnels to isolate the reactor from areas of habitation.

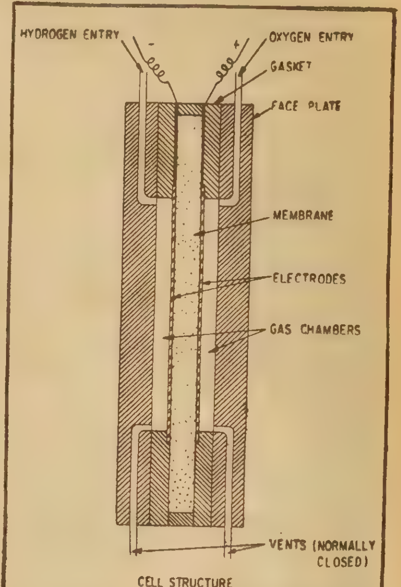
HOW THE HYDROX CELL WORKS

The Hydrox fuel cell, mentioned elsewhere on this page, is currently the object of much research and speculation throughout the world. This explanation, issued by the General Electric Company of America, indicates the nature of their experimental cells.

THE fuel cell, according to Drs W. Thomas Grubb and Leonard W. Niedrach of the G-E research laboratory, consists of a round plastic disc about ½in thick and 3in in diameter.

Its hollow interior is divided into two chambers by a special plastic membrane, which has an electrode in contact with each of its sides (see diagram).

Hydrogen is fed into one chamber and oxygen into the other (or oxygen in the air can be used).



CELL STRUCTURE

At one electrode, the hydrogen molecules break up into electrons and positively charged hydrogen. The electrons travel through an external load circuit to the other electrode, thus creating an electric current.

The positively charged hydrogen moves through the membrane to the other electrode, where it combines with oxygen and the electrons from the external circuit to form water.

The fuel cell generates electricity by a chemical reaction.

In the present version, hydrogen and oxygen produce an electric current, with water as a byproduct.

Current densities as high as 30 ma to the square centimeter have been achieved with an open-circuit voltage of approximately 1 volt per cell. Thermal efficiency of 60 per cent has been reached.

NEW JET EFFICIENCY

SOME idea of the advances which have been made in turboprop engine efficiency is given by a recent announcement from the General Electric Co.

America's new T64 turboprop engine has more than twice the power-to-weight and consumes half the fuel of the United States' first turboprop engine, the T31, which was developed in 1941.

Detailed technical information on the T64 was disclosed for the first time by General Electric and the United States Navy. The turboprop weighs 1,079lb and produces 2,570 h.p. Being developed for the U.S. Navy, the T64 is also built as a turboshaft engine for large helicopters. This version weighs 854lb and can produce 2,650 shaft horsepower.

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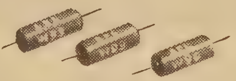

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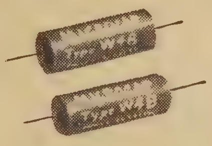

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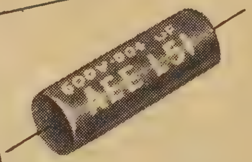

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FROM THE EDITOR — IN EUROPE

John Moyle, Editor of "Radio, Television and Hobbies" is currently in Geneva, attending the Administrative Radio Conference of the International Telecommunication Union. He sends back these impressions of the European scene, thus far.

THE air trip to Europe was noteworthy by the assiduous efforts of all to make it comfortable, but it is obvious that the jets hold the key to long-distance travel. Three days and two nights broken at all hours by short stops is an ordeal.

To cut this time by half, plus a comfortable silence, is well worth a little bit of smoke at Mascot!

Already the jets are to be seen in action on this route. A beautiful Comet 4 came in to land at Bangkok (with very little smoke) and lined up alongside the Constellations, looking much the same for size, but with a quite individual grace.

At Athens a French Caravalle took to the air in a hair-raising climb and with that banshee howl now characteristic of the jet engine.

PISTON PLANES OUT

Difficulties and early setbacks will mean nothing to the progress of the jet aircraft. Soon the piston plane will be archaic on the big airways except perhaps for freight.

* * *

When I was last in Europe the month was March, the winter had been hard and even in Italy, where sunshine is traditional, most of the time it was bitterly cold. Trees were bare and the fields were brown. The Swiss Alps were over- eavy with snow and he streams were beginning to move again nder their covers of ce.

Today, in August, here is transformaion. In Rome there as a heatwave with emperatures into the ineties and with hot ights which gave ttle relief. On the ve of summer holidays, the Roman populace sweltered away the summer evenings in footpath cafes; the children dipped into the fountains of the city squares; the trees were in leaf and helped shield the ancient city from its sunbath.

As in Florence, Milan, and the holiday towns along Lake Maggiore, a second population filled the streets; one which comes from other countries every summer equipped with guide books, cameras and every kind of transport. People of all colours and languages mix themselves together in the old world to look over its treasures and capture its atmosphere.

TRYING WEATHER

Even in Geneva, further to the north, the weather is still hot, and at times quite trying even by our standards. Hotel ventilation doesn't seem to follow normal practices; either you leave your windows open and are kept awake by the traffic, or you shut them and suffocate. Even the best hotels, and mine is one, have heating facilities but no air conditioning.

* * *

That traffic! Everyone comments about its speed and at the risk of repetition I do so too. In Rome there seems to have been some effort to slow things down and elsewhere there seems to be more respect for one's person at pedestrian crossings.

But the new menace of the motor scooter, small motor cycle and powered pushbike is now in full boom. These things have an almost childlike belief that no one will be crossing a street when they swoop around the corner—which they do at full bat!

In Rome, I was intrigued at hearing what I took to be hordes of cicadas strangely migrated to a strange land, but I was wrong. These petrol-eating buzz-flys are equipped with electric buzzers which make a loud noise which I need discuss no further. Motor horns and headlights are not allowed on the Continent except for occasions of distress.

You have to learn that their functions are interrelated at night, for headlights flashing on and off are the only warning of a speedster approaching a corner. And you cower against the wall in the narrow streets until he goes by!

* * *

Geneva is a beautiful, gay, realistic and hard-headed city, almost completely French in outward forms such as language, but speaking Italian, German and English quite freely at most of the places where it counts.

PRESENT, NOT PAST

There isn't very much of the old city left except a small portion near the old Cathedral, but that isn't important, because Geneva doesn't rely on its history for its appeal.

It is the neutral meeting place of the world. It houses the Palais des Nations and, like all Switzerland, does handsprings to make you feel this is your

☆

hotograph taken dur-
g the second Plenary
ssion of the ITU con-
rence. Australians,
ft to right, are: Mr
. Strohfeldt, Group
ngineer (radio) P.M.G.
ept.; Mr A. W. Hat-
ld, Sectional Engin-
r (Technical Services)
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ard; Mr. L. J.
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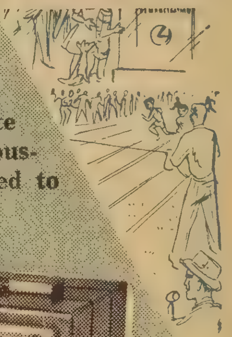
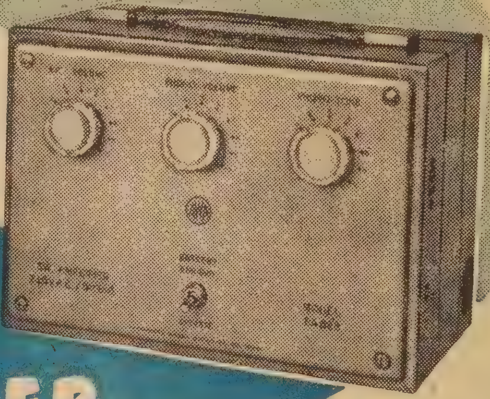


Type PA828 amplifiers may be operated from 240 volt or 6 volt battery supply, changeover being effected by alternate cables which are stowed in rear of housing. A standby switch is provided to conserve battery life.

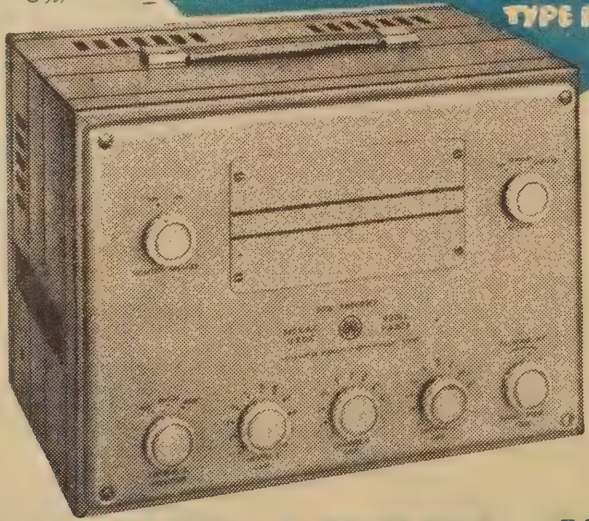
5 WATT AMPLIFIER

TYPE PA 828



20 WATT AMPLIFIER

TYPE PA 829



Type PA829 20 watt mains or 12 volt battery amplifier provides all facilities necessary for P.A. Hiring.

These include two microphone channels with third optional channel for microphone or pickup. Either high or low output pickups can be used. Features include a battery saving switch and a bass cut switch to control L.F. response when using horn speakers. A plug-in V.U. meter and monitor speaker with their associated switches are ancillary units.

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ovely curtain and cataract of spray.
even tons of water are in the air at
ny one time and it leaves the nozzle,
or 10 inches across, at a speed of 125
niles an hour.

At night it is lit by white light from
elow and from the side. It is the
mplest, yet one of the most beautiful,
nan-made spectacles I have ever seen.

* * *

TV in this part of the world seems to
ave moved on as it has done else-
here In Italy it has completely gone
om the cafes, at which so many small
udiences would gather at night. Whether
is is the effect of summer alone I do
ot know, but it seems to be sold in
odest quantities and without much
terprise.

Only once walking the streets have I
en it demonstrating, in a small shop
a Florence lane, but this may have
en due to the fact that programs are
ot broadcast all the time. A figure of
o million Italian sets was given to
e but I don't know how accurate this
ay be.

The few times I was able to see pro-
ams—Italian and Swiss standards are
e same as ours—I could see little dif-
rence between them and our own from
technical viewpoint.

On one program, in a Swiss hotel
unge devoted to TV for its guests,
saw a Eurovision performance of Act
of the Meistersingers from Bayreuth.
though the singers and performance
re much better than we could com-
nd in Australia, there was nothing in
staging which we could not have
ualled or bettered.

Many faults to be seen — displaced
es, dropped frames and interference
terns may have been part of the local
gineering — there is only one low
wered TV station in Geneva, but they
re there. I am looking forward to
ing some French TV this weekend
l later rechecking on the English
ndards.

* * *

The only musical event I have come
oss so far was a performance of
ida" at an outdoor theatre in Rome,
ich is world famous. It is built in the
ns of the Serme di Caracalla, an
ient Roman baths.

This outdoor setting, in which the re-
ins of two tall towers mark the
its of the proscenium, is ideal for
e and spectacular scenes, such as
se in "Aida" in which the Egyptian
ars, temples, and even the Collossi
ch flanked the temple door in the
e scene, were life size.

The program says the stage is 32
res long, with an area of 1,500
are metres, and the "hemisphere"
re the audience sits houses 10,000
ple. Emphasis is placed on the
ity of this huge place to give com-
e realism.

When Radames makes his entry with the victorious Egyptian troops, he comes up from the backstage ramp in a chariot drawn by four horses at a full gallop, sliding to a halt before the throne of the Egyptian king.

In this triumphal scene there must have been four or five hundred people on stage — too many to count — and the trumpets sounded from vantage points about 15ft high. And they were real trumpets.

I would never have believed that outdoor acoustics could be so good. My seat wasn't too far back, and the voices were all powerful, but I could hear every syllable and every note of the big orchestra.

Fortunately the night was warm and there was no wind, for the performance, like all others in Rome, started at 9.15 p.m. But this one ended at 1 a.m., and many people went home in special buses.

This performance not only because of its lavish and realistic setting, but because of its musical worth, remains one of the most impressive things I have seen and heard in this part of the world.

The big Telecommunications Conference which I have come here to attend has only just got under way. As expected the first week was taken up by presentation of reports, collection of additional proposals, and agreeing to procedure and the setting up of committees and working groups to handle the mass of material to be considered.

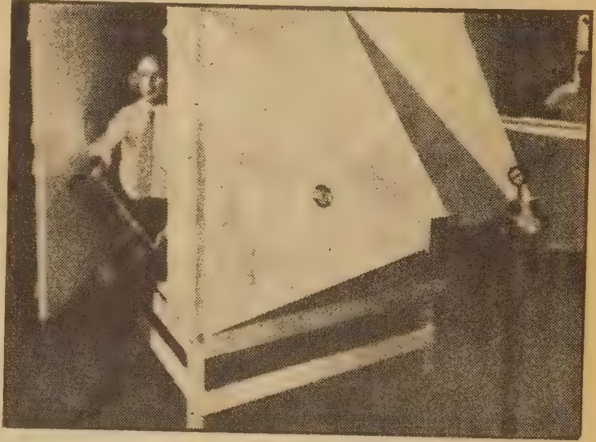
It is an irksome thing, for there are inevitably long periods during which no matters in which one is vitally concerned are being considered. But each day means new people to meet and talk with. As an arena in which to become familiar with the world's work in communications, both past and future, it is, of course, an education.

It is unwise to comment on the work of the conference as it progresses, because decisions are subject to alteration during the various stages almost at any time, and do not become official until approved of by the full sittings of the conference at later stages.

In the amateur radio field, as expected, Australia is not the only country with unfavourable proposals for band allocations but at the moment there is nothing which can usefully be added to what has already been written and said.

LOUDEST CONTROLLABLE NOISE?

In a sprawling red brick building close by the Delaware river, RCA Industrial Electronics Products engineers have developed an instrument that they believe will produce the loudest controlled noise in the world. It is the RCA Compressed Air Loudspeaker or CAL.



THE RCA researchers have not yet had an opportunity to turn the CAL loose in full cry, but they are certain the dual-horn noisemaker can throw the human voice 10 miles or more and out-shout 450 conventional loudspeakers.

The engineers did not put CAL together out of a sheer love of bedlam They were motivated by a need to produce higher intensity noise levels than ever before in order to test and develop sensitive electronic equipment for the jet and space era.

Standard electronic instruments cannot withstand the terrific noise levels attained in today's jets and rockets. Extreme noise plays havoc both with humans and the instruments they carry or send aloft at supersonic speeds.

In the case of the human body, the sound levels attained at the wingtips of a jet plane cause a vibration that reaches unbearable proportions. The same noise intensity can shatter electronic or mechanical equipment, or cause malfunctioning. A radar unit or altimeter without proper protection against such buffeting can give pilots and ground observers false information.

RCA began experimenting in acoustical test engineering 30 years ago. Out of those experiments came a high intensity noise testing system, using electrical power alone.

By means of banks of loudspeakers and a soundproof chamber, the RCA engineers were able to create "in flight" noise for most test applications in the pre-jet and pre-space period.

As a standard, an elevated train has a noise level of about 100 decibels. But a difference of 45 decibels doesn't tell the whole story. A sound of 110 decibels is 10 times louder than one of 100 decibels, a sound of 120 decibels is 10 times as loud as 110 decibels and so on.

With the coming of more advanced modes of aerial travel, the engineers searched for a bigger noise source that didn't involve complicated and bulky test systems.

In their search, they turned to compressed air — in effect taking a page from the book of the small boy with a lungful of air and a gap between his teeth.

(Continued on Page 127)

Tiny birds, like the warbler, fly staggering distances each year, often without alighting for days on end. This particular one, caught in a severe storm, was blown in flight, right across the Atlantic.

Do Migrating Birds Fly By The Stars?

For more than a century the methods by which birds navigate themselves in their migratory periods has been the subject of scientific attention.

by Calvin Walters

EVERY year in the autumn of northern Europe and England an irresistible urge causes the flight of millions of birds to distances thousands of miles away from their nesting places.

Most of the birds travel to Africa where they willl be found in various parts, even to the far south.

Different species of birds migrate to different places.

WARBLER & CO.

For instance, a well-known resident of northern Europe named the warbler and his relations, the whitethroats and blackcap, migrate to Africa.

The whitethroats fly across the Balkans and make their way up the Valley of the Nile. Other species migrate by way of Spain and Gibraltar. In all cases the birds know exactly the way to go.

Then there is a species of curlew which nests on portion of the coast of Alaska but spends the winter in the Pacific islands of Tahiti, Hawaii and other islands over 6,000 miles from its home.

During these journeys the minimum sea crossing is one of 2,000 miles.

A North American bird, the Golden Plover, also travels from northern Canada to the Hawaiian islands. This bird cannot alight on the water for a rest, as it is not possessed of webbed feet. It must therefore fly for weeks without a stop over the thousands of miles of ocean.

The flying feats of these birds are staggering in their magnitude. Perhaps the longest migration is that of the Arctic Tern. This bird normally nests in the Canadian Arctic about 10 degrees from the North Pole. When the Arctic winter approaches it travels by way of the west coast of Africa and spends its time on the Antarctic pack ice, returning to its home when the Antarctic winter approaches.

The journey back and forth is equal to travelling around the earth at the Equator.

Another outstanding feat of bird navigation was performed by an English bird called the Manx-shearwater. One of these birds was taken by plane to Boston and released. In 12 days time it was back home again in England in its nest. It had found its way over more than 3,000 miles of ocean.

The fact that some birds travel by night and others by day has caused some confusion as to the methods used by the birds to navigate themselves.

NIGHT TRAVELLERS

If the birds which travel by day use the topography of the land masses to guide themselves, this could not apply to the night travellers.

Clearly these birds could not pick out the topography of the land when flying at night hundreds of feet up in the air. Furthermore if the night were cloudy the birds would become lost.

It has been thought for many years that migratory birds must be possessed of an innate orientation instinct which enables them to find their way to their destinations.

Many theories have been promulgate regarding the essential mechanism and up to a few years ago, none have bee really acceptable.

Scientists have gone to fantasti lengths to try and verify their respectiv theories or account for the guiding instinct of birds.

The homing instinct of pigeons ha very naturally taken a lot of investig tion. In order to try to measure th distance which a pigeon flies from th time it is released to the time of i arrival at home, investigators have d vised some ingenious contraptions.

In 1950, Wilkinson made a sma cylinder having at one end some rad active material which produced alp particles. At the other end was a sen tive photographic film.

PARTICLE TRACKS

When the alpha particles impinged the photographic plate they made tracks which were visible when the film was veloped. The number of tracks indica the time of exposure.

Now the cylinder was provided w a special shutter which was interposed tween the radio active source and photographic film. This shutter ope only when the cylinder was horizontal

The idea was to attach the device the wing of a pigeon so that it was h zontal when the bird's wing was spr out in flight. This would measure ctual time the bird spent in flying during he period of its absence.

In practice, however, the device was ot very accurate, due to a number of actors, including that of a non-uniform ecrease in the strength of the radio-ctive source.

Another suggestion was to trace the ird's flight with radar.

While radar equipment can pick up choes from flocks of birds it would be ecessary for the echo from a "wanted" ock to be distinct from an unwanted ock. To ensure this would require ome kind of beacon mounted on the ird which would give an echo which ould be recognised as coming from that articular bird.

VEIGHT PROBLEM

The lightest weight equipment known ould only be carried by very large rds. An added difficulty was the limited nge of the radar equipment when birds ere flying at only a few hundred feet titude. This could only be overcome providing a chain of receivers. Such idea was ruled out because of cost.

As long ago as 1905 a scientist named xner tried out a scheme using camphor.

He fixed open-ended tubes containing mphor to the bodies of pigeons. The mphor was evaporated at a rate cording to the flow of air through the be. The greater the rate of flow of the greater the evaporation of the mphor. Thus by weighing the tube fore and after a flight, Exner thought could calculate the time spent in flight.

The results were not up to expectations several reasons. Firstly, the rate of aporation of the camphor was influ-ced by temperature. Secondly, a ong wind blowing through the tube ile the bird was grounded also caused camphor to evaporate.

Another scheme which had a measure success was the tracking of pigeons following them in an aeroplane.

All these fantastic schemes have been perseded by a far less complicated and re reliable method.

As the bird is released, it is watched of sight by observers with powerful oculars. The time taken for the bird fly out of sight and the point at which does so is recorded.

CATTER DIAGRAM

Under a particular set of conditions with a large number of vanishing nts recorded, what is called a scatter gram is built up. Cross bearings are ained by two observers located at ne distance from each other. Thus scatter diagram will give a fairly urate picture of the bird's flight k.

Whilst all these methods were designed find out the direction of flight of ratory and homing birds and the time en in flight, there still remained the blem as to how the bird finds it

erhaps the oldest theory is that which posed that the bird is provided with e sort of sensory apparatus which bles it to detect the north and south gnetic poles and from this to get a ring.

wo factors have exploded this ry. The first is that no examination he biology of a bird has detected any e which will respond to a magnetic field. The second is that the bird's flight is in no way impaired when strong magnets are attached to it during flight.

BIRD'S EYE VIEW IS DIFFERENT

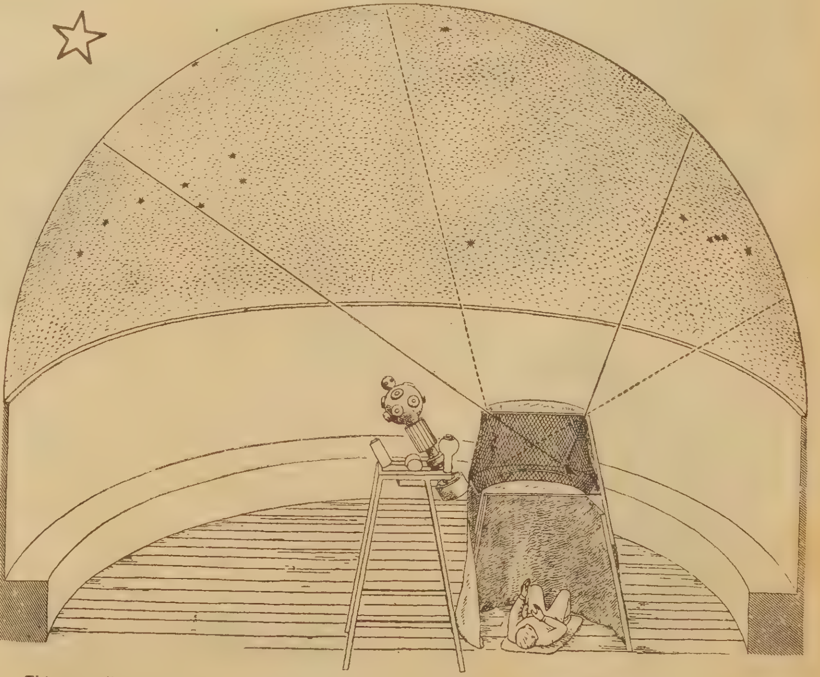
The structure of a bird's eye is basically different from a human eye and there is even a suggestion that some have a built-in "artificial horizon."

Another theory is that the birds can detect their location and get bearings from the Coriolus Force. This is a force which is not easy to explain in non-technical language. It is a force brought about by the rotation of the earth and is exerted so that it can be detected in the space around the earth. The force varies according to the latitude.

The most recent exponent of this idea is Professor Yeagley of U.S.A., with whom I had the pleasure of communicating on this subject some time ago.

Professor Yeagley put forward the idea that the Coriolus force could be detected by the bird as a sideways force. He carried out extensive experiments in an attempt to prove the theory.

Certain complicated calculations have more or less thrown this theory into the discard.



This excellent diagram reproduced from "Scientific American" illustrates the experiment carried out with caged birds in a planetarium. Bird sees the sector of sky indicated by the solid lines.

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7.5 watts per channel for stereo (15 watts for monaural use) with .1% harmonic distortion.

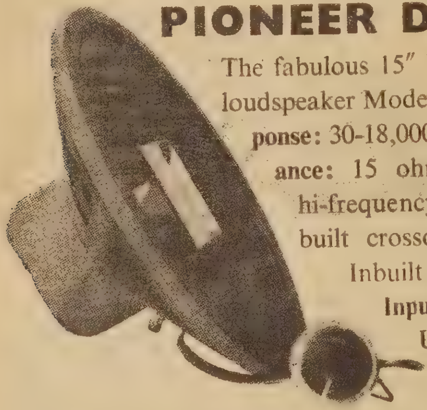
HUM:
—53 db below maximum output.

FREQUENCY RESPONSE:
±0.5 db, 20-20,000 cps.

EQUALIZATION:
RIAA & NARTB

INPUTS:
Tape, Phono (Magnetic & Crystal), Aux.

PIONEER DUPLEX



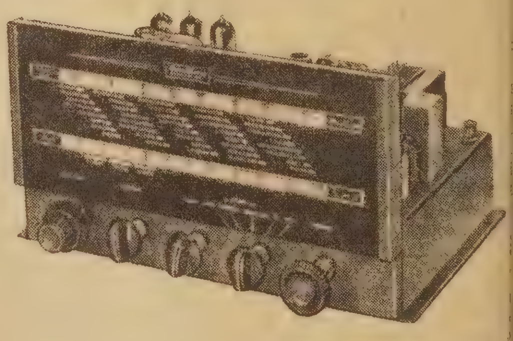
The fabulous 15″ Pioneer Duplex loudspeaker Model Pax 15B. **Response:** 30-18,000 cycles. **Impedance:** 15 ohms. Finger-tip hi-frequency adjustment. Inbuilt crossover and horn. Inbuilt HF driver unit. **Input:** 25 watts. Nett User Price **£49.**

PIONEER 8″

High performance 8″ Pioneer Co-axial loudspeaker. Years ahead in reproducer design. **Response:** 40-20,000cycles. **Input:** 8 watts. **Impedance:** 15 ohms. Extra heavy magnet, inbuilt crossover. Nett User Price **£11.2.6**

R081

THE BRITAMAR AM-FM STEREO CHASSIS



A complete stereo radiogram chassis read to install. British manufacture. Top performance in radio AM & FM stereo or monaural operation. 6 watts output.

Nett User Price **£59.10.0**

- **You can't buy better than Pioneer . . . one of th top sellers in the U.S.A., Europe and Unite Kingdom.**

HI-FIDELITY SALES

158 Clarence Street,
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Another theory suggested that the birds could fly along pressure gradients in the atmosphere. In other words the bird was sensitive to pressure changes, could select the isobar which connected all points of equal barometric pressure and ly along the selected isobar. There is no evidence to support this theory.

The theory that birds, animals and in-ects can orientate themselves by means of the sun is not new. It is a known act that the sun has a tremendous in-luence on the behaviour of all life and hat birds, animals and insects definitely use the sun as a guide in their local vanderings.

To assert, however, that birds use the un as a compass during the thousands f miles of flight in their migrations was nother matter indeed.

JSE THE SUN

In Germany, Gustav Kramer in 1955 nd G. V. T. Matthews in England car-ed out some remarkable experiments hich seemingly have given accurate evi-ence that some birds at least navigate y the sun.

Kramer enclosed a starling in a small age which was placed in a pavilion pro-ided with six small windows equally paced around the wall. No view of utside landmarks was possible for the rd.

During the period of migration the rd was noticed to have a tendency to ce in a certain direction.

This directional tendency of the bird as estimated by an observer who looked through the bottom of the cage.

When the sky was overcast the bird owed no directional tendencies, but nmediately the sky became clear the rd orientated itself in the position fac-g the direction it would normally fly nen migrating.

Next experiment used two mirrors, nich were placed in the windows in ch a way that the deflection of the cidence of the sunlight altered the parent position of the sun. Immedi-ely the bird responded and its direc-n was altered to the same degree.

Because of the fact that this experi-nt could only take place during the tlessness produced in the bird during migratory period, Kramer found a y to experiment all the year round. trained starlings to follow one com-ss direction only when enclosed in the ge.

MULATED EFFECTS

The same tests with mirrors and ob-ring the sun produced the same orien-on in the trained bird as it did with natural orientation tendency in the rained bird.

Kramer also trained the birds to feed one direction only from 12 containers anged in a circle. The feeding took e at a particular time of day.

y feeding the birds at different times mer found that the birds still assumed trained direction notwithstanding that direction made a different angle with sun. Kramer deduced from this that birds were able to allow for the daily ements of the sun and were provided the facility which allowed them to nate the passage of time.

urther involved experiments have ed fairly conclusively that birds do actually orientate themselves by means of the sun.

The big question was how? Have they a built-in sextant? It has been suggested that the bird makes use of the various angles made between itself and the sun's position in its arc and automatically learns its latitude and longitude.

The mathematical considerations are too involved to go into here, but it has been fairly well established from experiment that a bird can and does use the sun in a manner similar to a navigator on board ship.

Further support for this theory has come from more accurate studies of the eye of a bird. It has been found that a bird's eye is well adapted for acute angular discrimination and the detection of movement. It is at least three times better than the human eye.

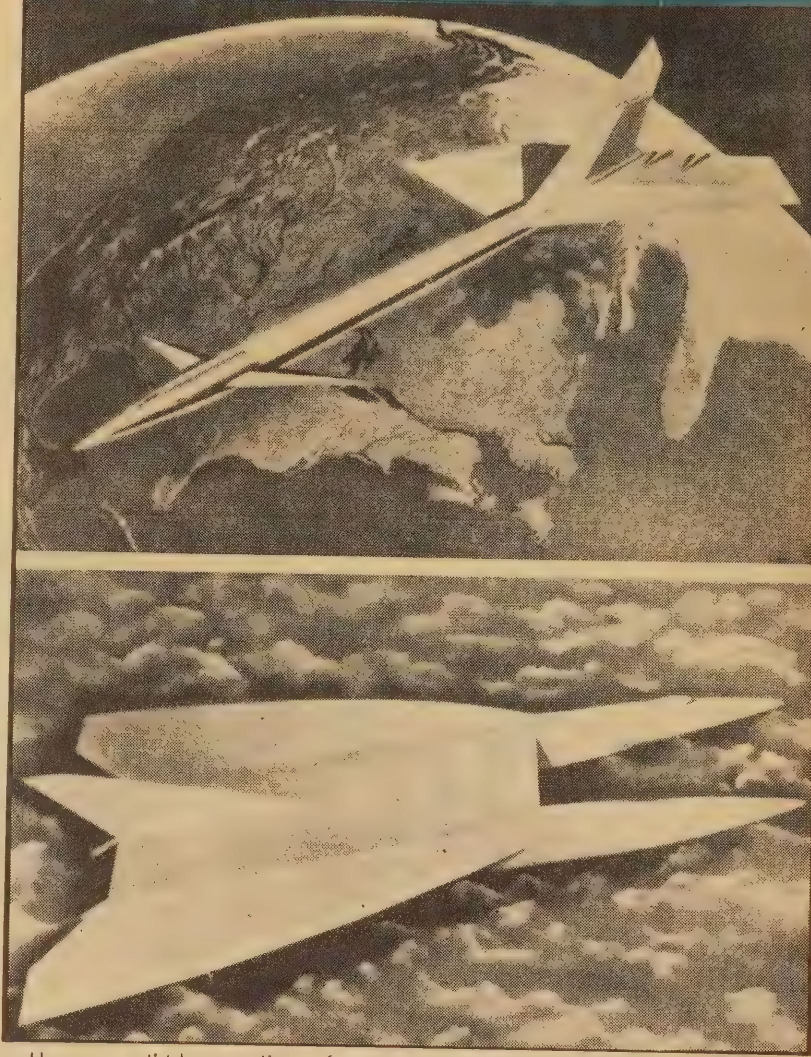
The pupil remains fully open in bright sunlight. Nearly all of the retina lies in the focal plane so that the bird has a clear sharp picture over the whole visual field.

The result is that distant objects are as sharply focused as near objects and the bird does not have to focus on an object in order to detect movement.

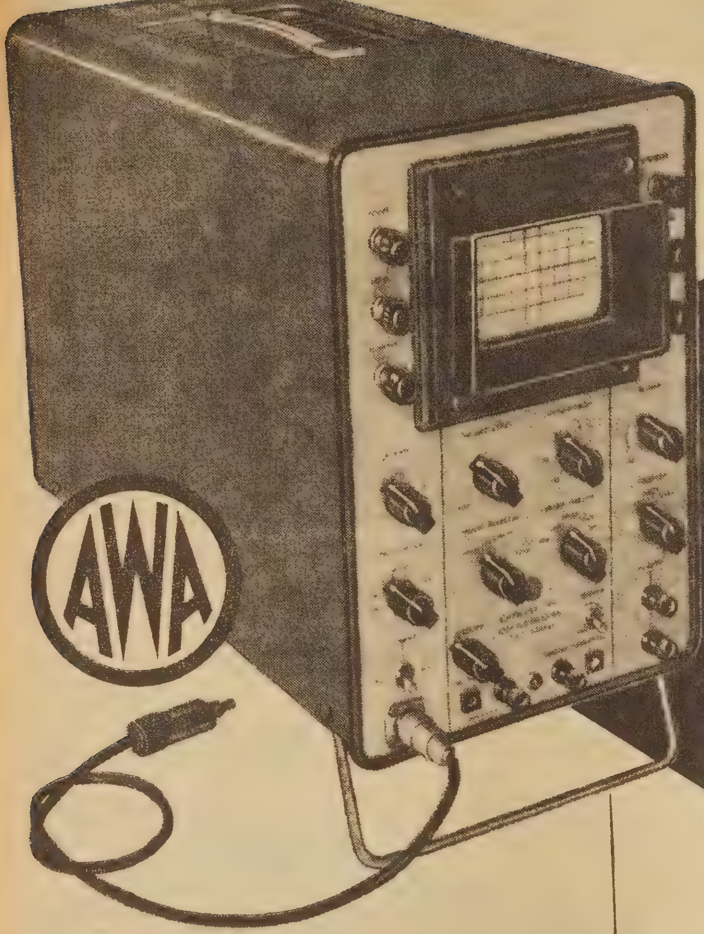
A bird also has a remarkable stability of its head during flight which would enable it instinctively to measure small angles and detect slight movement. The head remaining perfectly steady in flight, despite the flapping of the wings, can be likened to an artificial horizon which enables an aero pilot to measure angles without referring to the natural horizon.

(Continued on Page 121)

PLANS FOR 2000 m.p.h AIRLINERS



Here are artists' conceptions of two supersonic passenger planes conceived by British and American engineers as possible with present technical knowledge. Both are said to be capable of speeds over 2,000 miles an hour. The Lockheed Aircraft Corporation model at top would have trapezoidal or delta wing at rear of the fuselage, with tail arrangement in front for optimum trim control. The British version at bottom, by Bristol Siddeley Engines Limited, could carry 130 persons London to New York in 98 minutes, engineers say.



THE NEW CATHODE RAY Oscilloscope

TYPE 1A56069

FEATURES:

- WIDEBAND VERTICAL AMPLIFIER
- TIME AND VOLTAGE CALIBRATION
- AUTOMATIC SYNCHRONISING
- BUILT-IN TV SYNC. SEPARATOR
- PROVISION FOR OSCILLOSCOPE CAMERA
- INPUT FOR INTENSITY MODULATION

BRIEF SPECIFICATION

Vertical Amplifier :	Sensitivity : 100mV P-P/cm Bandwidth : zero to 6 M/cs for 3db down.
Time Base	Range : 1 µsec/cm to 0.5 sec/cm ± 10% Magnifier : Variable from 1 to approximately 5 times
Horizontal Amplifier :	Sensitivity : 0.9V P-P/cm. Bandwidth : 2 c/s to 200 kc/s for 3db down
Cathode Ray Tube	5-inch types : DB 13-54, DG 13-54, DN 13-54, DP 13-54 to suit your requirements of persistence and colour.

A versatile laboratory instrument for television servicing, industrial and general applications ; its ultra-wide bandwidth ensures faithful wave-shape reproduction. This coupled with accurate time and voltage calibration makes possible the analysis of all complex waveforms.

For further particulars contact Test and Measuring Instrument Department.

AMALGAMATED WIRELESS (AUSTRALASIA) LTD.

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B 0233	MU 9161	J 1631	BA 5945	43-191

Technical Review

NEW TYPE OF TV COLOUR TUBE MAKES ITS DEBUT

With patents already issued and assigned to it, Andromeda, Inc. of Kensington, Md. has its engineers busily working toward an early public demonstration of a new colour CRT and its associated receiver.

S with previously proposed systems, the proponents feel that this one y provide the break-through to mass olic acceptance of colour television.

Advantages claimed include full comibility with standard colour signals transmitted at present, improved retion quality and receiver reliability, uced service requirements and a size reduction ("at least 30 per cent") the cost of the set.

f these claims can be realised, colour for 350 dollars or less should be result.

leart of the system is a one-piece our CRT with a single electron gun. vever, the gun will simultaneously t three electron beams so closely ed as to minimise convergence and stration problems.

olour phosphors are deposited on the of the CRT screen in the form ,500 fine horizontal strips: red, blue, green.

etween the gun and the faceplate e is no intervening physical element beam control, such as a shadow mask vire-grid element.

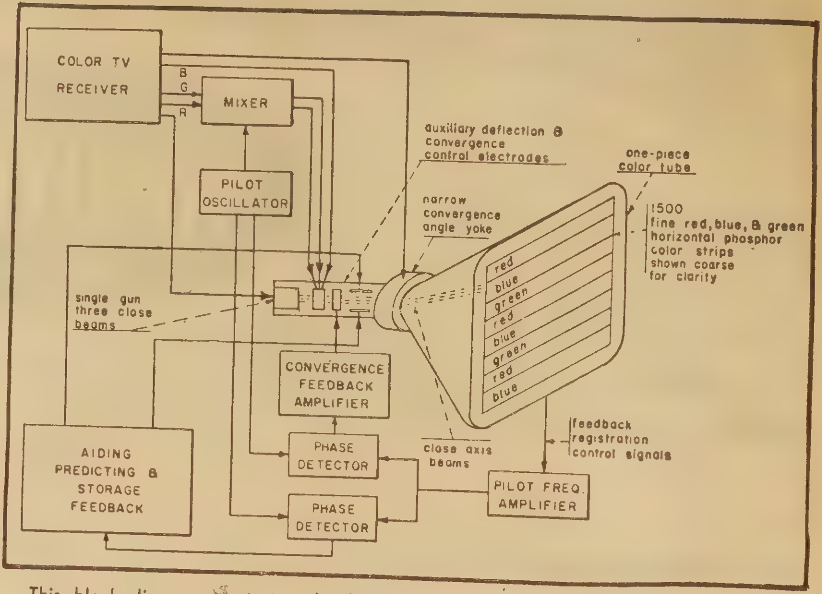
XILIARY CIRCUITS

sitioning and coordination of the beams is obtained electronically circuits that operate auxiliary conence and control electrodes in the . This technique is said to provide oved resolution and brightness output ogether with high reliability.

e one-piece, non-critical CRT can nade economically, the designers as can the deflection yoke, which d be similar to its monochrome erpart.

een and red beams are modulated weak, 10-mc. pilot carrier, used in n-critical manner. This signal is ed to each beam in a different .

ot-frequency output is reported to low that no interference problems Errors in registration are moniand detected by a feedback net-work said to be similar to such circuits used in radar design.



COLOR TV RECEIVER
B
G
R
MIXER
PILOT OSCILLATOR
auxiliary deflection & convergence control electrodes
one-piece color tube
narrow convergence angle yoke
1500 fine red, blue, & green horizontal phosphor color strips shown coarse for clarity
red
blue
green
red
blue
green
red
blue
single gun three close beams
CONVERGENCE FEEDBACK AMPLIFIER
feedback registration control signals
AIDING PREDICTING & STORAGE FEEDBACK
PHASE DETECTOR
close axis beams
PILOT FREQ. AMPLIFIER
PHASE DETECTOR

This block diagram illustrates the basic principles on which a TV colour receiver would operate, using the proposed Andromeda tube.

Resultant correction signals are used to maintain beam alignment within close tolerances through the entire raster area. Standard, low-cost components may be used in the supplementary corrective circuitry required by this system.

Whatever additional cost this requirement entails, proponents feel, is more than offset by the elimination of the more elaborate circuit needs of other systems, by cost reductions possible in the use of a relatively simple, one-piece, non-critical CRT, and by less stringent requirements for associated circuits and components, many of which will be no more elaborate than those generally found in black-and-white TV receivers.

HIGH BRIGHTNESS

The absence of beam-obstructing devices permits good brightness output.

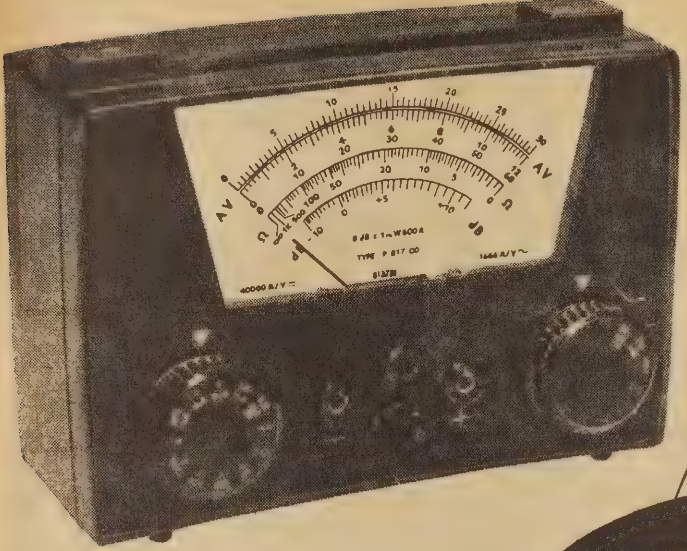
A final, specific design for the entire circuit of the supporting receiver does not appear to have been selected yet. However, Andromeda president, Arnold Lesti, reports tests have proved the basic principles to be sound.

The functional block diagram illustrated here will apply in any case. Until now, experimentation has been conducted with a few specially built tubes. The CRT is not in mass production.

It is hoped that a completed, operative colour receiver incorporating this tube and system will be ready for demonstration in a few months.

Less Strontium from All-Grass Pastures

BY growing 16 species and strains of forage plants on three soils, similar except for their calcium and native strontium contents, and analysing the herbage after eight weeks, H. V. Koontz of Davis, California, and P. B. Vose, of Aberystwyth, have shown that legumes take up much more strontium than any grass—three to six times as much in some cases. This knowledge has a practical application in combating the hazard of radio-strontium in milk produced from pastures contaminated by fission fallout. The figures quoted in "Nature" (Vol. 183, p. 1447) indicate that cows grazing a legume-grass pasture will ingest more radio-strontium than cows on an all-grass pasture, growing on equally contaminated soil.



PHILIPS

new

Multimeter

40,000 Ohms per Volt DC sensitivity has been made possible by a new method of meter movement supension enabling sturdy construction of the 25µA meter.

28 Ranges

DC

Volts 0-60 mV to 0-1200V (with EHT Probe 0-30 KV) Current 0-30µA to 0-3A.

AC

Volts 0-3V to 0-1200 Current 0-600µA to 0-3A	30 c/s - 10kC/s

OHMS

0-1000Ω 0-100 KΩ 0-10 MΩ

The instrument features:—

1. **40,000Ω/V DC voltage sensitivity**
2. **Protection against overload.**
3. **Current transformer for AC measurements.**
4. **Low to high ohms ranges.**
5. **Light construction for portability.**

Carrying case with shoulder strap is availab

PHILIPS ELECTRICAL INDUSTRIES PTY. LIMIT

SYDNEY • MELBOURNE • BRISBANE • ADELAIDE • PERTH • HOB

P105

PHOTOELECTRIC SCANNERS CONTROL BUS TRAFFIC

To reduce bunching and irregular running of London's buses, scanning units at several checkpoints detect the passage of a bus and relay the running number in binary form to the route display panel at control centre.

TRAFFIC congestion is a problem in most major cities. Today, more than ever, electronics is being called on to solve it. What's being done in London is one example.

That city's traffic congestion is complicated by the fact that the London Transport Executive operates 500 bus routes with a fleet of 7,000 buses.

The resultant congestion manifests itself in buses of the same route becoming bunched together and also becoming considerably delayed with respect to scheduled time.

The bus electronic indicator to be decribed gives the bus operators a picture of bus distribution at a central control point, thus permitting early action in the vent of service irregularities.

Equipment in current use is illustrated n block form in Fig. 1. Basically, a ingle modulated beam of light is reflected from a two-colour binary coded reector plate mounted on the side of the ehicle and detected by colour-discriminating photoelectric cells.

The two outputs from these cells are nplified at the modulation frequency id the signals so formed are compared id stored by a cold-cathode trigger tube rcuit.

The stored information is then transitted over telephone lines to the conol centre using conventional relay techques. The binary information is deded to decimal form and presented as illuminated number on a section of route display panel.

In traversing its route, each bus passes number of check points and at each int its running number is registered at control centre in the appropriate lay section and cancelled out of the ceding section.

Installations such as this, almost unnoticed by the kerbside, keep a constant check on passing bus traffic, feeding the information back to a central control point.

The display panel therefore shows the nber of buses between check points, r running number and the pattern of ement along the route. Display el data are also available for reing in permanent form for subent analysis.

LECTOR PLATE

he reflector plate is designed to clip cradle attached to the front near of the bus above the cab.

flector buttons are of the type normused in road signs and are arranged rtical rows of three buttons at 5/8in es to give some degree of compensafor vehicle loading.

e horizontal spacing of each vertiow of reflectors is 2in., which gives se rate of 350 pps when the vehicle velling at 40 m.p.h.

ar reflectors are used to make up inary number and the interdigital are marked by red reflectors; with ses operating on the route selected e pilot trials, only five digits are ed in the code.

nning units are provided at selectcking points along the route; they are erected on the pavement at the same height as the identity plates and as near as possible to the roadway.

The light source is a standard prefocus transverse-filament, 48-w automobile headlamp bulb operating at 90 per cent of its rated voltage.

The modulated light reflections from are accepted at the scanning unit by a lens and mirror arrangement which directs these reflections simultaneously onto the photosensitive surfaces of two photoelectric cells; one cell responds only to the reflections from the clear reflec-

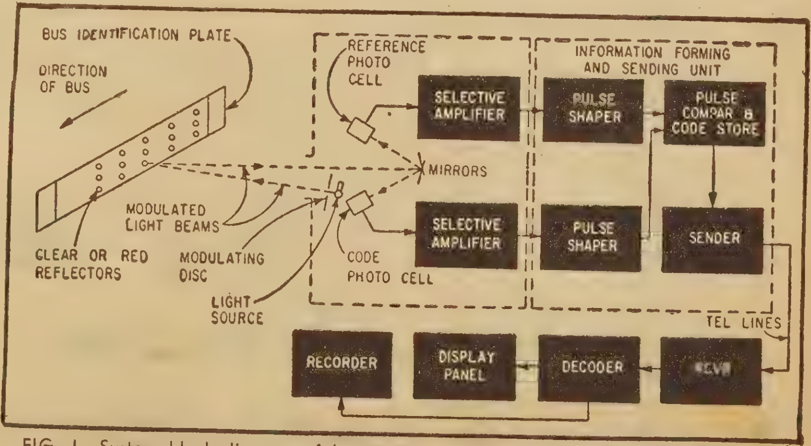
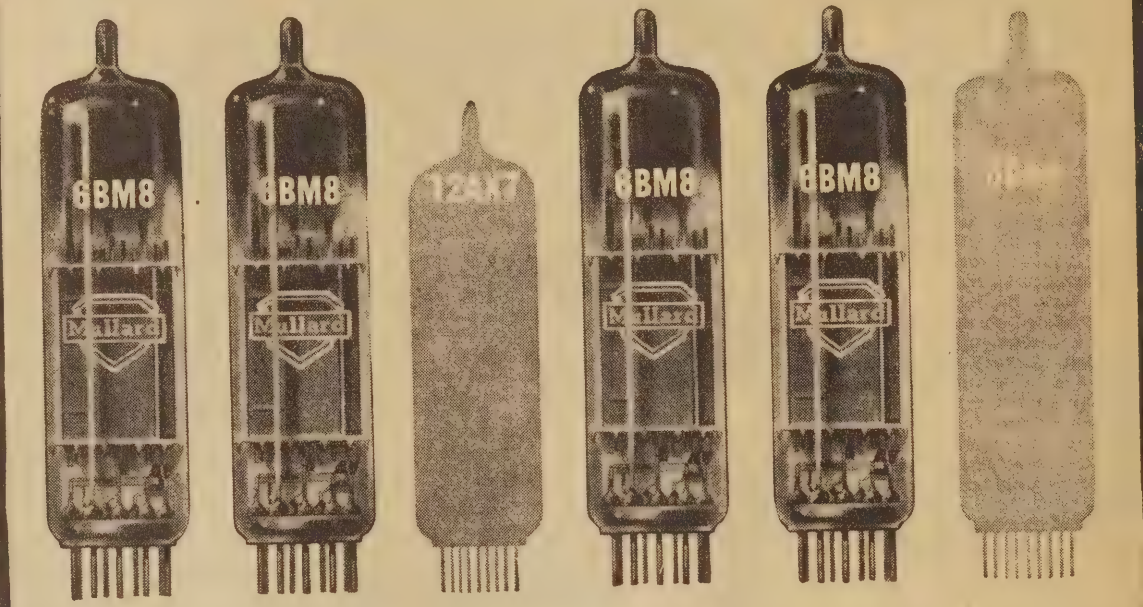


FIG. 1—System block diagram of bus scanning system. Data from bus identification plate on side of vehicle is detected by scanner unit and converted to binary form before transmission.

complete valve line-up for high quality STEREO SOUND



6BM8/ECL82

TYPICAL OPERATING CONDITIONS

Single valve class 'A'

V_a	250	V
$V_{g2(b)}$	250	V
†R_{g2}	2.2	kΩ
$I_{a(o)}$	28	mA
$I_{g2(o)}$	5.5	mA
$I_{g2(max.\ sig.)}$	10.5	mA
V_{gl}	—22.5	V
R_k	680	Ω
$V_{in(r.m.s.)}$ (P_{out}=50mW)	780	mV
R_a	9.0	kΩ
$V_{in(r.m.s.)}$	9.5	V
P_{out}	3.4	W
D_{tot}	10	%

Two valves in class 'AB' push-pull

V_a	250	V
$V_{g2(b)}$	250	V
††R_{g2}	2.7	kΩ
$I_{a(o)}$	2 x 21.5	mA
$I_{a(max.\ sig)}$	2 x 27.5	mA
$I_{g2(o)}$	2 x 4.2	mA
$I_{g2(max.\ sig)}$	2 x 9.2	mA
†††R_k	390	Ω
$V_{in(gl-gl)r.m.s.}$	38	V
R_{a-a}	10	kΩ
P_{out}	9.0	W
D_{tot}	5.0	%

† Undecoupled screen-grid resistor.
†† Common screen-grid resistor undecoupled.
††† Common cathode bias resistor.

The addition of the 6BM8/ECL82 to the Mullard world series range of valves for audio enables the construction of a complete high quality stereophonic amplifier with ONLY FIVE VALVES plus a rectifier. Used with a specially developed Mullard circuit, two pairs of 6BM8/ECL82 valves, one 12AX7/ECC83 voltage amplifier and one 6CA4/EZ81 rectifier will provide two complete ultra linear push-pull channels each giving an output of 7W at 0.3% total distortion. Full constructional details are included in "Circuits for Audio Amplifiers" price 12/6 or 13/3 post paid.

Copies are available from Mullard Distributors in your State or direct from Mullard-Australia Pty. Ltd., at the addresses listed below.

Mullard

Mullard

WORLD SERIES AUDIO VALVES

MULLARD-AUSTRALIA PTY. LTD., 35-43 CLARENCE ST., SYDNEY, BX2006, & 592 BOURKE ST., MELBOURNE,
ASSOCIATED WITH MULLARD LTD., LONDON, MULLARD EQUIPMENT LTD., MULLARD OVERSEAS

tors and the other to both clear and red reflections.

The modulated light reflections from the identity plate are thus converted into two trains of electrical pulses modulated at 5 kc by a motor-driven slotted disc.

One photocell is particularly sensitive to daylight radiation with a blue predominance and produces binary information; the other cell provides the reference pulses necessary to establish the zero level.

This arrangement gives adequate separation (a discrimination ratio of 30:1 is possible) and also perfect synchronism between code and reference signals.

EXTRANEOUS LIGHT

Two-stage tuned amplifiers within the scanner casing amplify the modulated signals and effectively reject the effect of extraneous light on the photocells. The signals are then demodulated to provide an output of two trains of negative d-c pulses of 100 v in amplitude from the scanning unit.

The information and sending unit, which accommodates a regulated power upply, pulse shaping circuits, pulse com- arator and code store, is enclosed with he sender. They are either packaged in weatherproof case for pole mounting r placed within a street pillar.

The circuit for comparison and stor- ge is shown in Fig. 2.

Square wave outputs from the pulse apers supply the common trigger lines f two chains of five cold-cathode trig- er tubes; V2 through V6 respond to the ming reference signals and V8 through 12 respond to the code signals. Tube 1 acts as a primer to raise the trigger tential of both V2 and V8 and thus epares the circuit for the receipt of coming signals.

GNALS TRANSFERRED

The plates of V1-V6 are coupled with mmutating capacitors which produce a nsfer from tube to tube, in step with incoming timing reference pulses; at completion of a total count of five, energises relay K1, which then ini- es the line sending circuits.

play panel at control centre pre- ts bus movement pattern in digital n. A recorder also maintains perm- anent record for analysis.

COMPARISON, STORAGE CIRCUITS

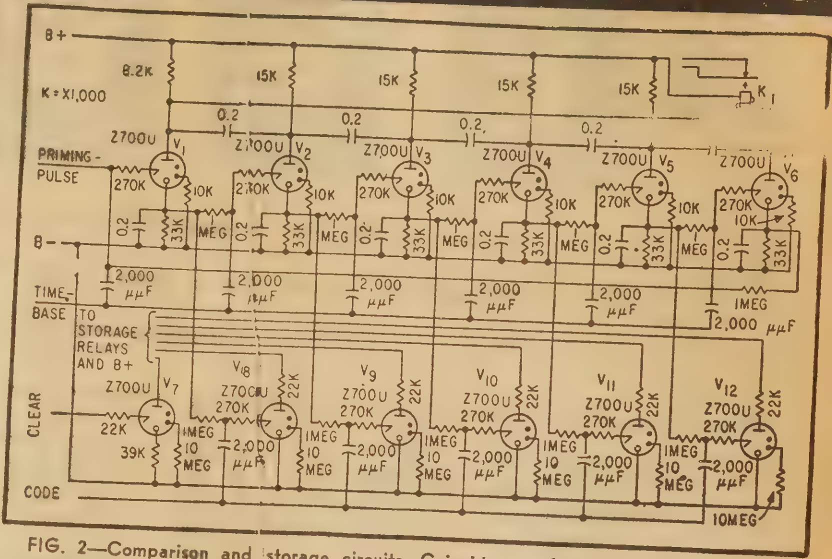


FIG. 2—Comparison and storage circuits. Coincidence of incoming code with reference pulse causes code tubes to fire in accordance with binary number present.

Since the bias is sequentially applied to V8 through V12 as V1 steps to V6, the coincidence of a code signal with a timing reference pulse causes the code tubes to conduct and either fire or not fire according to the digit or zero of the binary number present.

Tubes V8 through V12 actuate relays in their anode circuits which store the data until the sending sequence is completed; V7 in association with another relay acts as a clear-down timer so that spurious information and incomplete counts are dispensed with after a preset time interval.

PULSE TRAIN

Standard relays are used in the sender circuit and arranged to transmit the stored binary data as a series of 50-v positive and negative pulses at a constant speed of 10 pps. The pulse train consists of six pulses; the first five contain the identity information and the last is a resetting pulse.

Ordinary telephone lines connect the checkpoint equipment to the control centre. Rectifier polarised relays connected across the incoming line are operated in accordance with the polarity make-up of the pulse train.

They are arranged to switch in sequence a chain of timing reference relays in such a manner that any positive pulses occurring in the signal operate the appropriate relay in the code chain relays.

MINIATURE LAMPS

The display panel contains eight sections each having 30 miniature fluorescent lamps. If two lamps are excited at the same time, as when a bus passes from one check point to another, the current demand causes the voltage to fall and the previously illuminated lamp is extinguished.

(By T. S. Pick, Chief Electrical Engineer, and A. Readman, Testing Superintendent, London Transport, London, England. From "Electronics." See also Proc. IEEE Pt. B, Oct., 1958.)

A VACANCY ON OUR TECHNICAL STAFF

We have an immediate vacancy on the staff of "Radio, Television and Hobbies" for a radio engineer or an experienced technician capable of originating, constructing and describing the class of project regularly featured in these columns.

Academic qualifications and the A.O.C.P. are an advantage but not essential for the position. More than anything, we are keen to find someone who has had experience in the varied fields of audio, radio and television and transmission and who wants to extend and capitalise upon it as a technical journalist.

Applicants should be resident in Sydney and free to begin duties within one month of appointment.

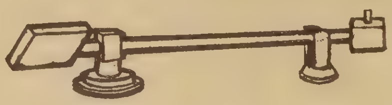
Applications should be made, in the first instance, by letter only, giving details of experience, copies of references and stating the order of salary required. Letters should be addressed to The Technical Editor, "Radio, Television and Hobbies," Box 2728C G.P.O., Sydney.

All correspondence will be treated with the strictest confidence.

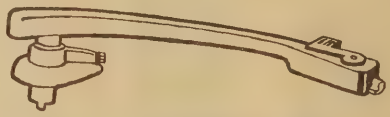
Upon appointment and subject to satisfaction and medical examination, the successful applicant will be eligible for four weeks annual leave, Accident and Sickness benefits and superannuation.

U. R. D. FOR

Build up to the thrill of stereophonic, High Fidelity reproduction. If you already have High Fidelity, all you need is a stereo pick-up head, a second amplifier

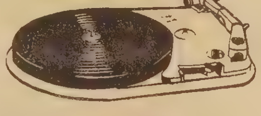


DECCA STEREOPHONIC PICK-UP
This pick-up has won incredible world wide acclaim. Fitted with a .0005 diamond stylus, it tracks perfectly at a pressure of 3 grammes. Discs played with it have shown no trace of wear after 120 playings. Produces fine stereo sound, and plays standard L.P. discs perfectly.

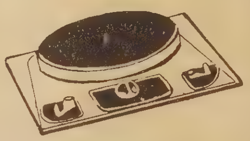


GOLDRING G.60 TRANSCRIPTION ARM
Wired with four contacts for Stereophonic and Monaural reproduction. Features four-contact plug-in shell so that any high-quality cartridge can be inserted. Special adjustment for height, weight and balance. Precision designed for high-quality equipment and all stereo applications.

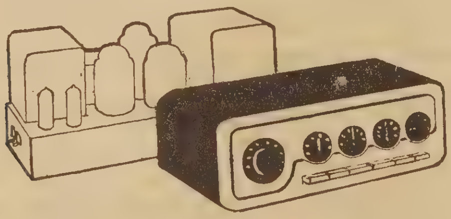
GARRARD STEREO RECORD PLAYER
High quality single record player complete with GCS10 stereo pick-up at reasonable price. Four speeds, selected by sliding knob. Speed variation of plus or minus 3%. Fitted with patent automatic stop with provision for disengaging. Plays records up to 16" diameter with minimum tracking error.



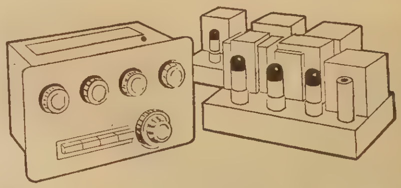
GARRARD 301 TRANSCRIPTION MOTOR



Turntable and mounting plate made in diecast aluminium. Robust induction motor floats on six tensioned springs. Turntable spindle made from high-quality steel, with bearings of cast phosphor bronze. Three speeds adjustable by plus or minus 2½%. Available from stock.



QUAD 22
A development from the world renowned Quad 11, Quad 22 incorporates refinements in design, greater flexibility of input and includes facilities for either stereo or monaural. Operates from discs, tape, radio or microphone, single channel or stereo. Power output: 15 watts throughout the range 20-20,000 c/s.



ROGERS R.D. JUNIOR AMPLIFIER AND STEREO-CONTROL UNIT.
This entirely new unit incorporates every essential for High-Fidelity reproduction from tape, records or radio. Can also be used for monaural recordings. The control unit may be used with two R.D. Junior amplifiers (20 watts output), or two R.D. Cadets (10 watts output), or one of each!

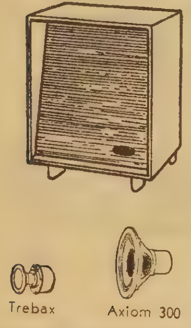
UNITED RADIO DISTRIBUTORS

STEREO IN HI-FI

with control unit, and a second speaker system.

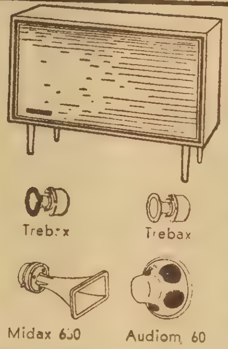
Write, telephone or visit, at U.R.D. you'll get all the help and advice you need.

Stereo without High Fidelity is like a picture without colour.



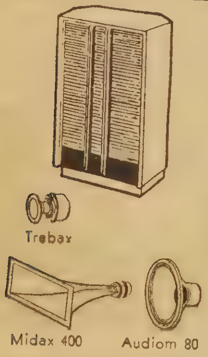
GOODMANS SHERWOOD 11

Balanced 3 — Radiator Twin-unit, Full-range, High-Fidelity Loudspeaker System. Bass and middle registers reproduced by an Axiom 300. At 5 Kc/s. signal is transferred to Trebax pressure-driven, high-frequency unit. Overall range, 30 c/s.-16,000 c/s. Capacity: 15 watts. Dimensions: 25½" x 23½" x 20½". Polished walnut or pine Plans available.



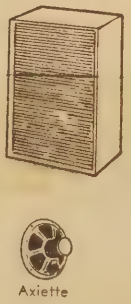
GOODMANS AXIOM 15/4

Entirely new quadruple Radiator Full-range, High-Fidelity Loudspeaker System. Overall frequency range, 30 c/s.-16,000 c/s. Bass Unit: Audiom 60 12" single-cone unit (30-950 c/s.). Mid Range: Midax 650 pressure-driven horn unit (950 c/s.-5,000 c/s.). High Frequency: Two Trebax pressure-driven horn units (5,000 c/s.-16,000 c/s.). Capacity: 15 watts. Dimensions: 19" (plus 7" legs) x 36½" x 13¾"



GOODMANS 325

Complete Three-unit High-Fidelity System. Overall frequency range: 30 c/s.-16,000 ~~c/s. Bass Unit: Audiom 80~~ 15" single-cone unit (30 c/s.-750 c/s.). Mid Range: Midax 400 pressure-driven horn unit (750 c/s.-5,000 c/s.). High-Frequency: Trebax pressure-driven horn unit (5,000 c/s.-16,000 c/s.). Capacity: 25 watts. Dimensions: 33" x 22" x 20½".



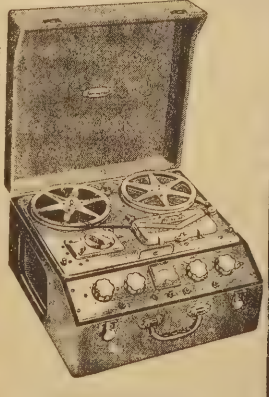
GOODMANS AXIETTE CABINET

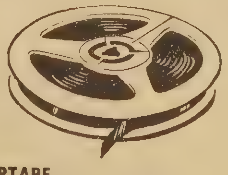
Single-unit High-Fidelity Loudspeaker System. Frequency Range: 40 c/s.-15,000 c/s. ~~Axiette speaker gives excel~~lent angular coverage at all frequencies. Power output—6 watts, yet only 8 inches in diameter. Operating at normal room volume, the most critical listener would be unable to distinguish between Axiette and more expensive systems.
Dimensions: 24" x 17" x 9¾".
Ideal for Stereo

FERROGRAPH SERIES 4

In this new development of the incomparable Ferrograph series, there are eight important design improvements. Every Series 4 is readily adaptable for a variety of applications. For example, the new head cover permits many head changes and additions. Also Series 4A is easily converted to a Series 4S merely by plugging in additional stereo head.

Series 4A/N, 4S/H: 3¾ x 7½ i.p.s.
Series 4A/H, 4S/H: 7½ x 15 i.p.s.
Stere-ad unit as required.





MSS MASTERTAPE

The only tape polished on both sides to almost eliminate surface noise. As a result of the fine finish of the working surface, wear is almost negligible and intimate contact with the recording and replay heads is assured. 7-inch spools. Standard: 1,200 ft. Long Play: 1,800 ft.

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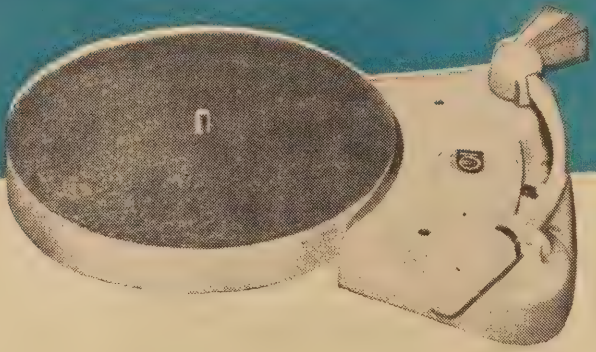
Now produced specifically for stereo operation, the popular Philips push-button record changer fulfils the exacting demands of this exciting new development in record reproduction.

21 GNS.

- **Two separate plug-in high-fidelity pick-up heads:**
  L.P. and Stereo type AG 3063;
  78 r.p.m. type AG 3066.
- **Plays all types and sizes of records—Stereo, L.P., 78, 45, 33⅓, 16⅔.**
- **Push-buttons for easy operation.**
- **Smooth, silent, wow and flutter free, absolute minimum rumble.**
- **Three separate functions.**
  1. Fully automatic changer—loads up to ten records.
  2. Automatic single play. Single records may be placed directly on the turntable.
  3. Manual single play.

PHILIPS



TYPE NG1009

A.C. Player with Stereo Counterweight and Stereo Pick-up Head

A pick-up arm counterweight is now available as an accessory for the popular Philips four-speed record player. With the stereo pick-up head plugged in, the counterweight reduces the needle pressure to the correct amount for playing stereo recordings. This removes the need to use inaccurate spring devices and the unit provides a compact stereo player for the widest applications.

NG1009—A.C. player with standard twin stylus pick-up head	**£10-9-0**
AG3063—Stereo pick-up head	**£2-7-6**
NG1023—Stereo counterweight	**10-6**
Mounting plate	**15-6**
NG1012—6-volt battery-operated version of record player	**£13-5-0**

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NEWS AND VIEWS OF THE MONTH

UHF moon relay

A REVOLUTIONARY radio communications system, using the moon as a relay station, is expected to be in regular operation between the U.S. and Hawaii before the end of this year.

It involves sending messages on a trip totalling about a half-million miles and taking about three seconds.

Extremely high frequency waves, which cannot ordinarily be used because they do not follow the curvature of the earth, will be used. They will be sent straight up and "bounced" off the moon. It is the first step in using the moon or an artifical satellite as a relay point.

The system will eventually open up many new channels of communication for the earth's already crowded radio bands.

Scientists anticipate that the space relay system would be largely immune from blackouts and other interference from phenomena of nature.

Some even say it's possible the system might be immune also from enemy jamming.

Australia in space

TWO announcements during the month suggest that Australia's place in the
pace age is becoming increasingly im-
ortant. One revealed that the satellite
racking station at Woomera had taken
he world's first photograph of the
'addle Wheel satellite in orbit. The Min-
ister for Supply (Mr Hulme) made the
nnouncement.

He said Australian scientists photo-
raphed the new U.S. satellite at a
eight of 14,000 miles.

The scientists had
nt the photographs
the United States
r processing and
amination, he said.
S. authorities later
nfirmed that the
otographs clearly
owed the paddle
eel in orbit.

The satellite sta-
n used a special
ker Nunn camera
take the photo-
phs.

'The photographs
a remarkable
ievement," Mr
lme added.

The central sec-
of the satellite
only 2ft in dia-
er, with four
dles 4ft long on
side."

Ir Hulme said
camera had
n other photo-
hs of the satel-
on two occasions
U.S. authorities had not yet assessed the results of these photographs.

The second announcement concerned a spaceship project for Australia. A two-man spaceship designed to operate from Australia was recently described at a Space-flight Conference in London.

The projected spaceship is dart-shaped. Its designer is Dr William Hilton, head of space projects for the Hawker-Siddeley organisation.

The ship is designed to re-enter the atmosphere safely and to glide to a landing in Australia.

Astonishing details of other preliminary work also have been revealed. These include moon landings, "get-back" satellites, and a revolutionary new engine for space launchings.

British experts claim that many of these projects are better and cheaper than United States and Russian devices.

The gathering of Commonwealth scientists and aeronautical experts will demand a joint Commonwealth program to "put the Union Jack into space."

The revolt of British scientists against their Government's tepid support of space exploration is likely to come to a head at the meeting.

Otherwise many of Britain's top brains will be lost to the United States, because they are frustrated at lack of opportunity at home.

Rugged beacon

A radio beacon, developed by General Electric, which withstands shocks of more than 5,000g has been used to recover freefalling data capsules carried in the nose cones of the Thor and Atlas missiles.

The beacon, which is easily capable of surviving a fall from the top of the Empire State Building—1,472ft high—emits signals which are picked up at over 100 miles.

Weighing only 18oz, the beacon has a peak output of 15 watts. It operates in the ultra-high frequency band, but can be modified to other frequencies. It is powered by mercury cells and can operate continuously for one and a half days on a 2lb supply.

General Electric also developed the data capsules and nose cones used in the Thor and Atlas missiles. The 18in spherical capsules are used to record information in outer space and to return it to earth at freefalling speeds. The data is returned on magnetic tape or on film.

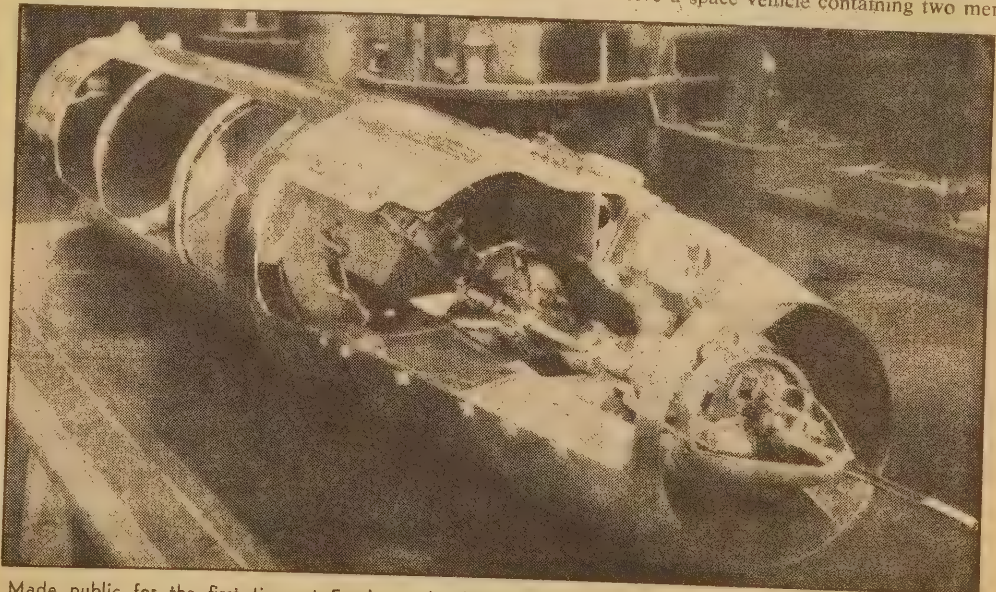
This recorded information assures that all flight data will be available in the event normal transmission from the nose cone in flight — which might be blacked out by ionisation—is interrupted.

The first data capsule ever recovered after a flight into space was produced by General Electric. This history-making capsule was recently accepted for permanent display in the National Air Museum of the Smithsonian Institution. The Smithsonian is the U.S. national Institute of learning and knowledge, comprising 10 different museums.

Nuclear space ship

SCIENTISTS at the Lockheed Aircraft Company are designing a new space vehicle with a mile-long tail containing a nuclear reactor. The device is intended to convert heat from the nuclear reactor directly into electrical energy for the rocket.

Theoretically, the scientists claim, the small, lightweight motor system could drive a space vehicle containing two men



Made public for the first time at Farnborough, this Bristol Siddeley Thor BT-1 ramjet was originally used to power the Bristol Ferranti Bloodhound surface-to-air guided missile. Less than nine feet long, sixteen inches in diameter and capable of being carried by two men, the Thor can develop the phenomenal figure of over 100,000 horsepower at Mach 3.

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- Full rated voltages all windings.
- Varnish impregnated.
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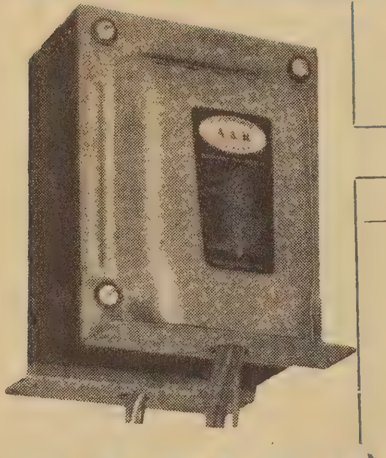
- Low temperature rise.

Type P.T.	D.C. mA	H.T. Volts Per Side	Rect. Fil.	Other Fils.
1880	60	250-0-250	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a.
1881	60	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a.
1882	60	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a.
1883	60	385-0-385	5v. 2a.	6.3v. 2a.
1884¶	80	250-0-250	6.3v. 1a. tap at 5v. 2a.	6.3v, 2a., 6.3v. c.t: 2a.
1885	80	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v, 2a., 6.3v. c.t: 2a.
1886	80	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.
1887	80	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1888	80	385-0-385	5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1889	100	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1890	100	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.
1891	100	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1892	100	385-0-385	5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a
1893	125	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1894	125	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.
1895	125	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1896§	150	250-0-250	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2a.



VLN 38 Mounting 125-200mA

Type P.T.	D.C. mA	H.T. Volts Per Side	Rect. Fil.	Other Fils.
1919†	125	300-0-300	6.3v. 1a. tap at 5v. 2a.	6.3v. c.t. 2a., 6.3v. c.t. 2.5a
1927	125	385-0-385	5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1928	150	285-0-285	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a.
1929	150	325-0-325	6.3v. 1a. tap at 5v. 2a.	6.3v. 2a., 6.3v. c.t. 2a
1930	150	350-0-350	6.3v. 1a. tap at 5v. 2a.	6.3v. 3a., 6.3v. c.t. 3a.
1931	150	385-0-0385	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1932	175	285-0-285	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1933	175	325-0-325	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1934	175	350-0-350	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1935	175	385-0-385	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1783	180	410-0-410	5v. 3a.	6.3v. c.t. 4a., 6.3v. c.t. 5a.
1936	200	285-0-285	5v. 3a.	6.3v 3a., 6.3v. c.t. 3a.
1937‡	200	300-0-300	5v. 2a.	6.3v 3a., 6.3v. c.t. 3.5a
1938	200	350-0-350	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.
1939	200	450-0-450	5v. 3a.	6.3v. 3a., 6.3v. c.t. 3a.

¶ Mullard 2-Stereo-2 Amplifier
† Mullard 5/10 Amplifier
§ Mullard 7w. Stereo Amplifier.
‡ R T V and H. Stereo.

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on a year's voyage through the solar system without refuelling. The nuclear reactor, containing 400lb of enriched uranium, would trail behind the main vehicle at the end of a mile-long coaxial cable.

This distance would protect the crew from radio-activity, dispensing with heavy lead or other shielding. The scientists in a recent report said: "This proposed vehicle seems within our technical capability."

Nuclear energy (heat) would be changed directly into electricity through "thermionic converters." The electric current would flow through the coaxial cable to the main spaceship, where it would heat a fuel element composed of the element cosium, inside a tungsten matrix.

The cosium would vapourise and its atoms would be stripped of their electrons. The resulting ionised particles would be accelerated by an electrically charged grid and shot through a nozzle like a jet stream.

The scientists expect even this very low thrust to send the vehicle and its trailing reactor along at high speeds.

Conventional rockets would have to be used to push the assembly clear of the earth's gravity.

Heart surgery

SURGEONS at three London hospitals performed heart operations on babies who had "stopped living" for a few hours, the London "Sunday Pictorial" said recently.

The newspaper said the babies' lives had been "suspended" by a new cooling method. Blood was drawn from the patient and circulated through a "refrigerator."

When it was pumped back, the body temperature had dropped to as much as 50 degrees below normal. By this time the heart had ceased to beat, breathing had stopped, and the patient was, in effect. "dead."

When the operation was over, the patient was restored by warming the blood supply.

The report quoted medical experts as aying that former methods of treating ole-in-the-heart patients involved the se of an artificial heart.

With the new method the chances of successful operation were increased.

First cargo sub.

BRITISH and Canadian interests have reached an advanced stage in their ork on what may be the world's first ommercial underwater ship. The subarine, known as "Moby Dick," will be iclear-powered and capable of carryg a large cargo.

Tank tests in the Saunders-Roe test nk near Cowes, Isle of Wight, have en carried out with different models to d the ideal weight, shape and depth operations for the submarine.

It has finally been decided to build a ssel of 50,000 tons. It will be 607ft ig, 72ft in diameter, and designed to erate at first at 300ft depth.

Bearing in mind the voyage of Naus under the North Pole, Moby Dick designed to play an important part opening communications to the icend regions of northern Canada.

Her first cargo will be 28,000 tons of ore, but she may be used for transting fuel oil.

STILL IN THE FOREFRONT!
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TRUVOX DECKS (3 only) slightly used, look and operate as new .... ONLY £31
PRE-AMPLIFIERS for Truvox or Collaro (new) £23/10/-
COMPLETE AMPLIFIERS £33/15/-
DAIWA 2-speed recorder (one only) £64

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Other types on application.
O/P Transformers for Playmaster 1 to 11 for the Mullard 3-3, 5-10 and 20-watt Amplifier Transformers Kit Set.
TV TRANSFORMERS for R. and H., Philips, A.W.A. Circuits.
TRANSISTOR TRANSFORMERS for all Circuits.
TRANSFORMERS ON MU-METAL, RADIO METAL and C-CORES.
REWINDS and any type transformers or coil to customer's specifications. Call, ring or write for quote on your needs.

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CANBERRA: CANBERRA ELECTRONICS, 4 Lansborough St., Griffith, A.C.T. X1324.
BRISBANE: STARLIGHT RECORDING CO., Penney's Building. B7336.

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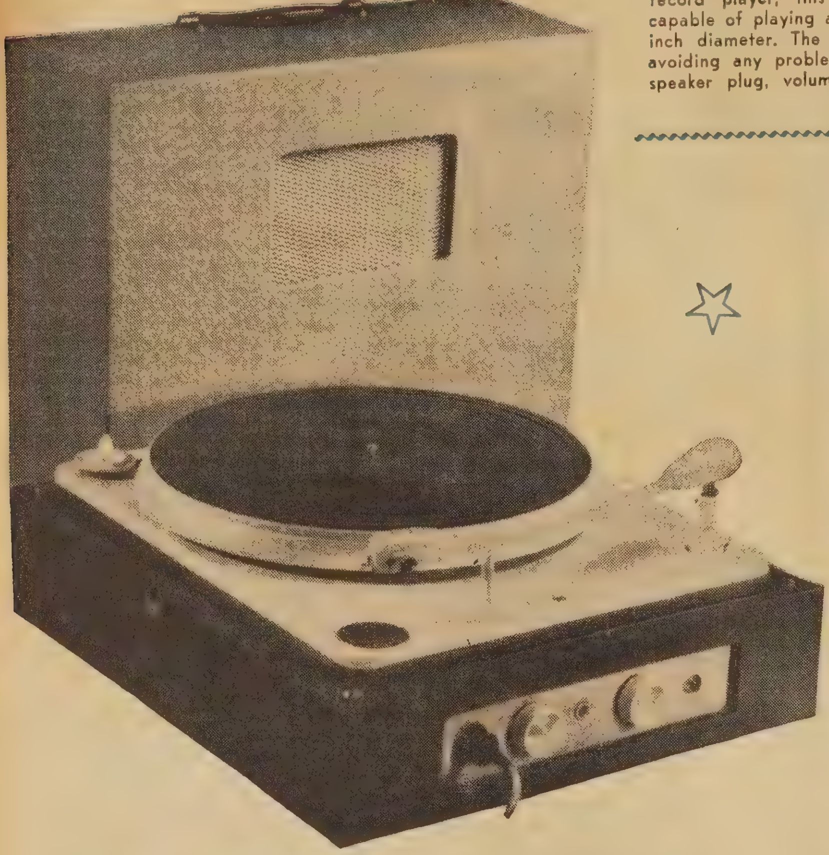


Larger and somewhat heavier than the usual portable type record player, this unit has a transcription-type turntable capable of playing all speeds as well as records of up to 16-inch diameter. The speaker is in the demountable lid, thus avoiding any problems with microphony. Front panel mounts speaker plug, volume control, input jack, tone control and indicator bezel.

Multi-Purpose Record Player

The use of amplifiers for special purposes is growing every day as recordings move into the field of education, reference and research. It is safe to say that almost every field of human knowledge and endeavour is supported in some way by information contained on discs.

by John Moyle

RECENTLY we had occasion to handle a simple project to cover requirements for which there was no apparent commercial equipment available, and as the need for it was very real, it seemed probable that there would be others of our readers to whom its design would be equally welcome.

Even though the original design may not be duplicated in every detail, the ideas which it contains could be readily adapted to meet individual needs.

GOOD QUALITY

This particular requirement was for a small record player of reasonable quality but not necessarily high fidelity, the main use for which was to play a large series of recordings in the field of musical research.

Recordings which had to be accommodated ranged from old 78 types made early in the century to modern LP's gathered from all parts of the world.

Some of the latest might well be on the slow 16 r.p.m. speed, and others were large 16-inch discs running at 33 r.p.m.

In other words the first need was for something which would play every type of 78 and LP and with a pick-up arm large enough for the 16-inch diameters.

As these records were likely to be played in all kinds of places, the equipment had to be portable, or at least capable of being carried about without too much difficulty.

This meant that it would have to include a built-in loud speaker.

In addition there were times when it was desired to play the discs to fairly large groups of people, and under circumstances where there would be opportunity to use something better than the small speaker on its equally small baffle.

This meant that provision had to be made for connection of an external speaker, and enough power output to give good but not excessively loud volume.

A 12-inch type of speaker in a vente enclosure would represent a typical external load for this purpose.

EDITING FACILITIES

In classifying the subject material, a facility for copying discs to a tape machine would be of great value, s that a series of excerpts could be brough together for rapid comparison and fo the editing of musical examples.

Finally there would be occasions whe a small amplifier for voice re-inforcemen would be of great value, and an inpu plug capable of accepting the output fro a high-gain crystal microphone looked t be the obvious way out.

Such an input plug would allow th amplifier to be used as a general purpos type capable of operating with all kind of inputs whether related to the require ment of the original user or not.

The only way one could obtain suc an equipment would be to have it buil or to build it. Specifications such these are out of the way unless includ in something far too bulky and costly suit many purses.

In deciding on the initial componen the first choice was for a suitable tu table.

SMOOTH MOTOR

Because it was to be used for copy and occasional room demonstrations good quality motor was decided up particularly as cheaper motors do normally come provided with long ar Such a motor is heavy and this adds the weight. On the other hand any who had no use for the long arm co use any kind of motor, his results be directly proportional to the quality cost.

The one we used was a Collaro tr scription type because it is a good re sentative of its class and because it available with the long arm.

It was fitted with a high quality t

over cartridge with a diamond for LP records and a sapphire for 78's.

The size of the cabinet is set by the size of the motor. The diagrams shown here give the dimensions we found suitable for it, but the same type of simple construction could be used for other dimensions if these are more convenient to use.

The high-grade pick-up has a lower output than some other types which can supply three or four times as much voltage. In his case the smoother response was considered to be much more preferable than output, for our little amplifier had no trouble in giving its full output with an input of about .2 volts.

Because loud volume was the least of the requirements, the amplifier itself was kept to complete simplicity. It used a 6BM8 triode-output-pentode connected in such a way as to give us about 2.5 watts from the secondary of the output ransformer.

SPEAKER LOADING

This is just about enough for the uilt-in speaker, and adequate for good olume from a more efficient and better affled external speaker.

The circuit is similar to that used or a simple stereo unit described in the ssue of March 1959.

The current drain of the valve is less han 40 mills so that the smallest and heapest type of power transformer will e suitable.

The 6V4 rectifier is the only other alve.

The power supply requires no filter hoke, and by the time we have included pair of 50 mfd, electrolytics, and a fur-her 8 mfds decoupler for the triode and e output screen, the hum level at the utput is virtually negligible.

Although our circuit shows two fila-ent windings, it would be in order to se the same one for both output valve nd rectifier.

The quality of the output from the ick-up was found to be quite good when layed straight into a .5 meg volume con-ol as the load, and that's the way it ayed.

O COMPENSATION

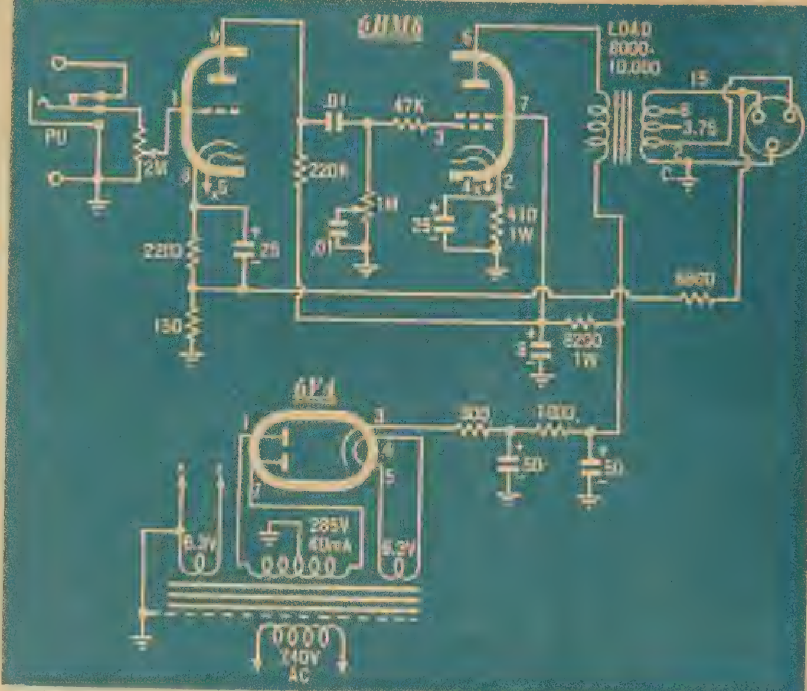
The makers often recommend special ompensating networks with some of ese higher quality pickups but all such tworks involve a considerable loss of tput. Many of them are practical, erefore, only in an amplifier which has large reserve of gain and this is not in this case.

The tone control is a very simple cir-it and is useful in rolling off the tops, rticularly if the records, as in this case, e sometimes old and worn. A more borate means of controlling surface ise was not considered necessary.

Because the output valve is not a high wered type, it is wise to use a reason-ly good quality output transformer to oid loss of power. Several of our ad-tisers make transformers specially de-ned for this valve, and they can be ommended. Although with a loss-less nsformer an output of three watts can expected, in practice we have found t 2.5 watts is nearer the mark with average transformer.

ost external speakers of any quality e an impedance of 15 ohms, but smaller types such as the oval included in the cabinet are nominally 2 ohms.

THE COMPLETE CIRCUIT DIAGRAM



The circuit is extremely simple but the performance is adequate for the purpose required. The filter input resistor minimises peak current in the transformer and makes for slightly cooler operation.

In order to cover both cases, it was necessary to provide a speaker socket with at least three pins, one for common "earth" and one each for 2 ohms and 15 ohms.

The portable speaker carries a plug wired for the 2-ohm connection, while the one for external connection can be wired for 15-ohms.

To avoid complications with feedback, it is taken in both cases from the 15 ohm winding, for whether the secondary is loaded with 2 ohms or 15 ohms the impedance specified should substantially hold in value, and the feedback will be the same for either connection.

Feedback is about 10db, quite enough to give a useful reduction in distortion, provide a cleaner overload, and good loudspeaker damping.

Tested with several high-gain crystal microphones the amplifier gave quite a valuable output for close speaking, and will allow a lecturer to move about freely

PARTS LIST

1 Chassis and panel (See diagram).
1 Power transformer 285V. 40 mA. 6.3V 2A.
1 Output transformer, 10,000 ohm primary, secondary to suit speaker.
1 Miniature 3 pin panel mounting socket and plug.
1 Double circuit jack (See text).
1 Chassis mounting, single contact bayonet socket and plug.
1 Indicator bezel, dial lamp, and holder.
2 Miniature 9 pin sockets.
1 Spring terminal.
2 2 tag terminal strips.
1 4 tag terminal strip.
1 8 tag terminal strip.
2 Knobs.
1 2 wire cable connector.

VALVES

1 6BM8.
1 6V4.

RESISTORS

½w unless specified.

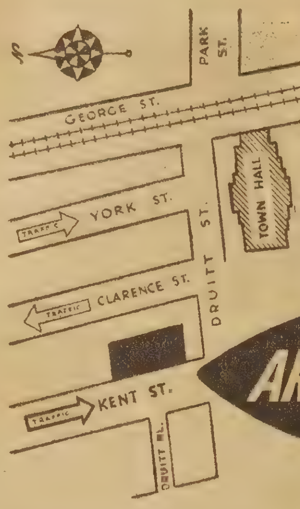
1 2M pot.
1 1M pot.
1 220K
1 47K.
1 8200 ohm 1W.
1 6800 ohm.
1 2200 ohm.
1 1000 ohm 5W.
1 410 ohm 1W.
1 300 ohm 3W.
1 150 ohm.

CAPACITORS

2 50 mfd 300V electrolytic.
1 25 mfd 25V electrolytic.
1 25 mfd 12V electrolytric.
1 8 mfd 300V electrolytic.
1 .01 400V paper or plastic.
1 .01 200V paper or plastic.

SUNDRIES

Nuts and bolts, hookup wire, 3 core flex, 3 pin plug, transformer mounting spacers (see text) etc.



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Rogers Cadet Amplifier.	29	12	6
Rogers Junior Amplifier.	41	5	0
Rogers Stereo Control.	48	0	0
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'G' Control Cabinets, from ..	19	19	0
Sherwood Cabinets ...	22	15	0
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	£	s.	d.
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Goodmans Axiom 300,	29	1	9
Audiom 60,	25	17	8
Trebax ..	12	5	3
Midax	21	18	3
Axiette ..	15	8	7
Rola 8MX	4	10	0
12MX	6	16	6
12UX	28	19	6
Wharfedale Super 3 ..	13	12	4
Super 8 FS. ..	13	0	3
Super 8 FS/AL ..	13	12	4
8/145	15	10	6
10in Bronze	11	0	0
Golden 10in	17	2	9
W 10 FSB	25	5	6
W 12 FS	28	1	9
Super 12 FSAL ..	44	3	7
Coaxial 12	64	0	0
W15 FS	44	3	7
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Monophonic Models ..	4	17	6
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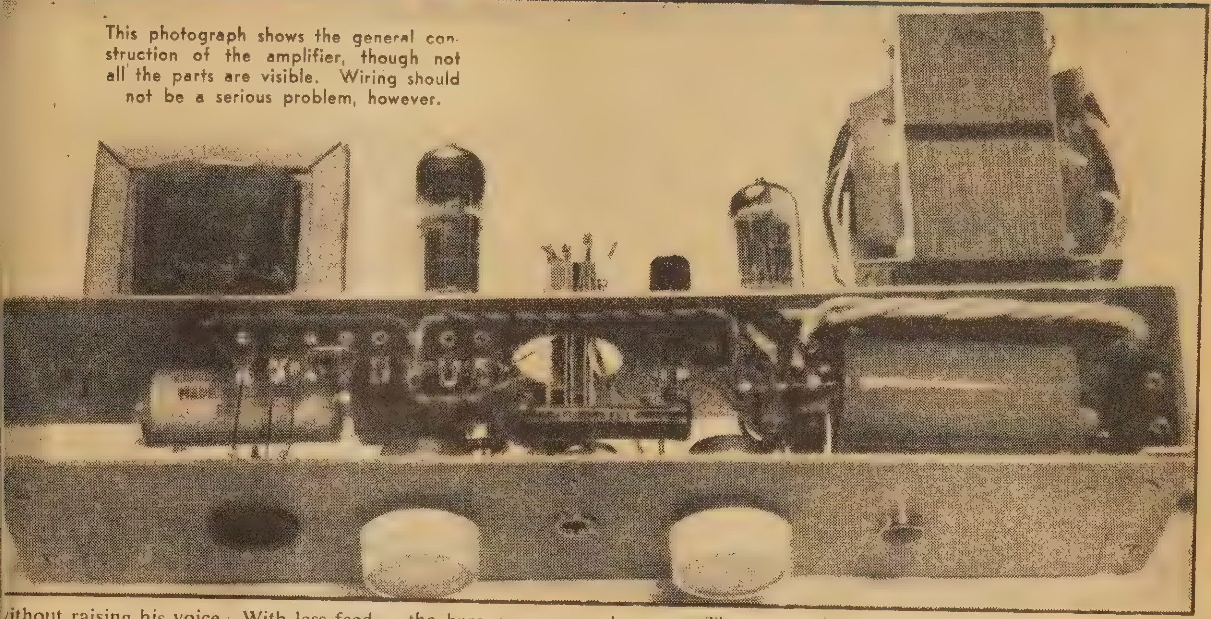


This photograph shows the general construction of the amplifier, though not all the parts are visible. Wiring should not be a serious problem, however.

/ithout raising his voice. With less feedack even higher gain would be obtained.

While there is therefore not a great eal to the story electrically, it did pose uite a few awkward and rather unexected problems.

Our original intention was to build ıe player up in the conventional fashion, ith the motor mounted in the lower ıd deeper section of the carrying case. nderneath the motor, we planned to put ıe amplifier and the speaker.

A few tests with the unfinished cabet, however, indicated trouble with a ıpital "T." Any attempt to play the ıuipment at consistent loud volume was warded by severe acoustic feedback, the usic giving place to a sustained howl.

We tried all the familiar tricks such as ıshioning the speaker, cushioning the otor, providing air relief vents, cutting the bass response and so on. The most obvious effect was to deteriorate performance, with feedback still just around the corner.

While the trouble could ultimately be made to come and go by tightening a particular screw or packing up a particular corner, at no stage could we honestly feel that it had been elimated.

SEPARATE SPEAKER

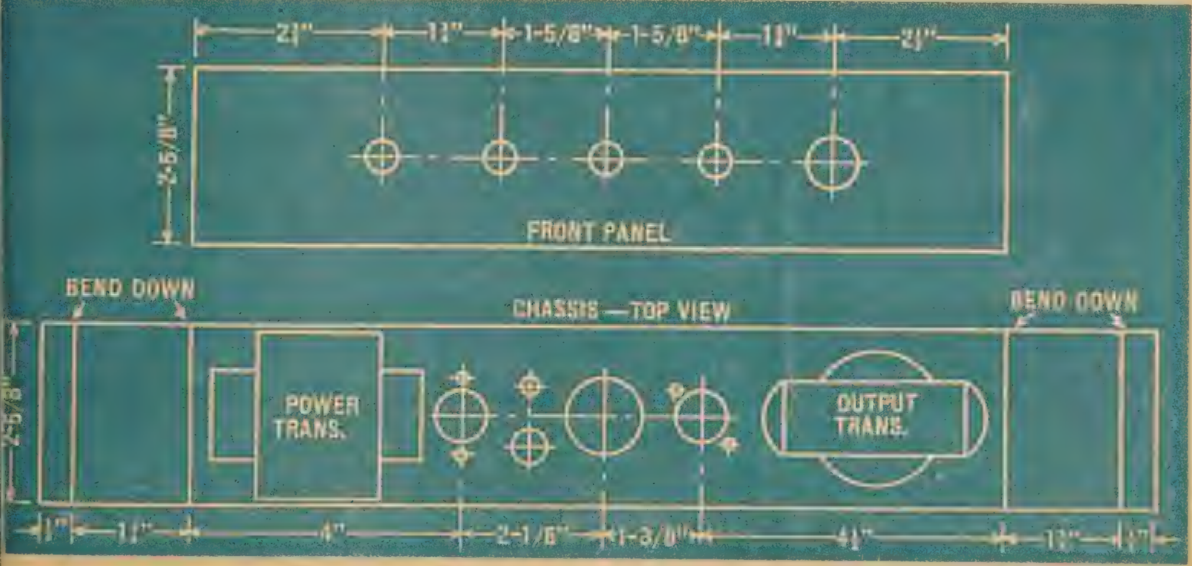
We could only put this down to a combination of circumstances, notably the use of a slightly more ambitious speaker than usual, a flatter and wider range pickup, the desire for high volume and the unusually large area of the motor and turntable baseplate.

Faced with this, we had to revise our thinking completely. To beat the feedback problem, the speaker had clearly to come out of the base section and go into the lid. Then, to avoid prohibitive overall dimensions, the amplifier had to be built in a form which would fit snugly as possible under the turntable.

Finally, we had to consider the amount of heat which would likely be generated in the now rather confined space.

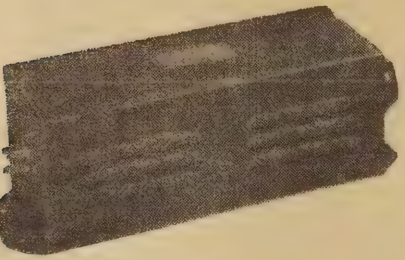
The photographs reproduced herewith indicate the form in which the amplifier was built. Most of the components were mounted on a single metal strip, folded to form three sides of a rectangle, with the ends turned inward.

The power transformer is at one end, mounted up on spacers to minimise heat transfer to the chassis and to the electrolytics underneath. The rectifier is alongside, with a couple of small tagstrips to support the filter input resistor



ǀere are the essential features of the metal chassis and panel in case you would like to make your own. The panel is covered with a cloth based plastic material attached by means of contact cement.

VOLTAGE REGULATION!



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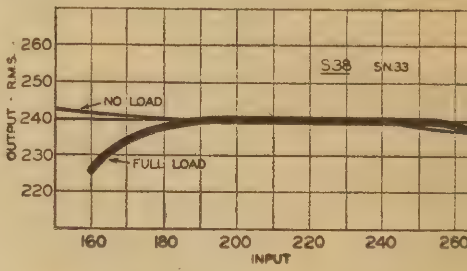

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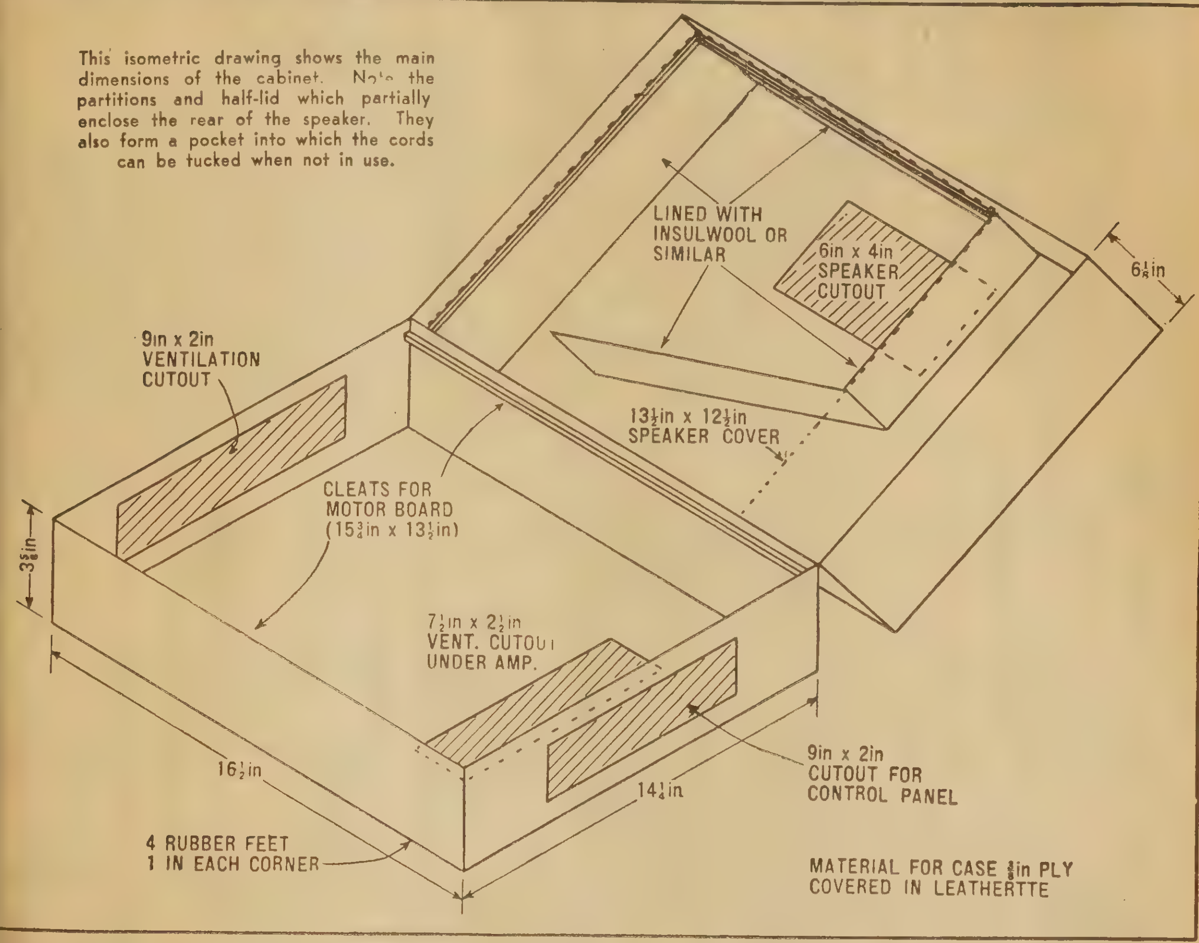
SKETCH SHOWS DIMENSIONS OF THE CABINET



This isometric drawing shows the main dimensions of the cabinet. Note the partitions and half-lid which partially enclose the rear of the speaker. They also form a pocket into which the cords can be tucked when not in use.

LINED WITH INSULWOOL OR SIMILAR
6in x 4in SPEAKER CUTOUT
6¼in
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13½in x 12½in SPEAKER COVER
CLEATS FOR MOTOR BOARD (15¾in x 13½in)
3⅝in
7½in x 2½in VENT. CUTOUT UNDER AMP.
16½in
14¼in
9in x 2in CUTOUT FOR CONTROL PANEL
4 RUBBER FEET 1 IN EACH CORNER
MATERIAL FOR CASE ⅜in PLY COVERED IN LEATHERETTE

nd other leads which need to be termiated.

For the mains connection, we used a rew type junction block bolted to the side end of the chassis. The incoming ains lead and the power transformer rimary are twisted and go into one end the block, leaving the other end vacant r the power lead to the gramo motor.

At the other end of the chassis is the tput transformer mentioned earlier and, ongside it, the amplifier valve.

Right in the centre is a clearance hole r the body of the phone jack and, arby, a shielded pickup input plug and earth terminal. For normal usage, e earth terminal can be used to earth e gramo. motor assembly to chassis, ile the pickup wiring passes through coaxial plug and socket, via the jack the volume control.

TERNAL SIGNAL

However, when a plug is inserted into jack, the internal pickup circuit is oken and an external signal source can fed to the amplifier, still via the volie control.

Most of the components and the wir- are concentrated on the chassis and job of building the amplifier can be npleted before the front panel is ewed into place.

This latter carries the aforementioned k in the centre, volume and tone controls on either side, with an indicator lamp and speaker output socket occupying the outermost positions. To add finish to the panel, it was faced with a layer of vynex cloth, secured by contact cement.

It is not our intention to issue a blueprint for the chassis because we regard it essentially as a specialist project. However, as a guide to anyone who may possibly want to build something along these lines, we have included a sketch giving a general idea of dimensions and mounting positions.

CABINET DIMENSIONS

A further sketch gives the essential dimensions of the cabinet. These should serve only as a guide and should be verified by anyone wanting to build something similiar. While everything fitted in the original, there is no guarantee that manufacturers may not vary some dimension for a particular reason, just enough to make things awkward. Or you may inadvertently reduce cabinet dimensions yourself by an eighth-inch or so, by too-willing use of the saw or plane.

An important feature of the lower and smaller section of the cabinet are the ventilation holes, one beneath the amplifier and the other at the end of the cabinet. They can well be covered with expanded aluminium but NOT cloth of any description, which would effectively prevent the flow of air through the cabinet.

Another important point is that the cabinet must be raised clear of the table on which it is resting, otherwise the ventilation slots become valueless. On hard surfaces ordinary rubber feet would be adequate but, to give better clearances on soft surfaces, we suggest the use of "S.S." rubbers, the initials discreetly disguising the function for which they are normally made and sold by hardware stores, namely for sanitary seats.

The lid containing the speaker should be demountable and slip hinges were used for this purpose in the original. The intention is that it should be stood in a position of advantage a little away from the rest of the equipment.

SPEAKER LOADING

In the original unit a 5-7 oval speaker was used, with an "F" magnet for maximum sensitivity. To improve the baffling effect—and also the appearance—a couple of partitions were added and a half-lid, enclosing the speaker. By this means the path for the back wave was considerably lengthened.

To minimise internal resonance effects, the partitions and lid were lined with pads of Insulwool, retained by scraps of cloth attached to the wood with drawing pins.

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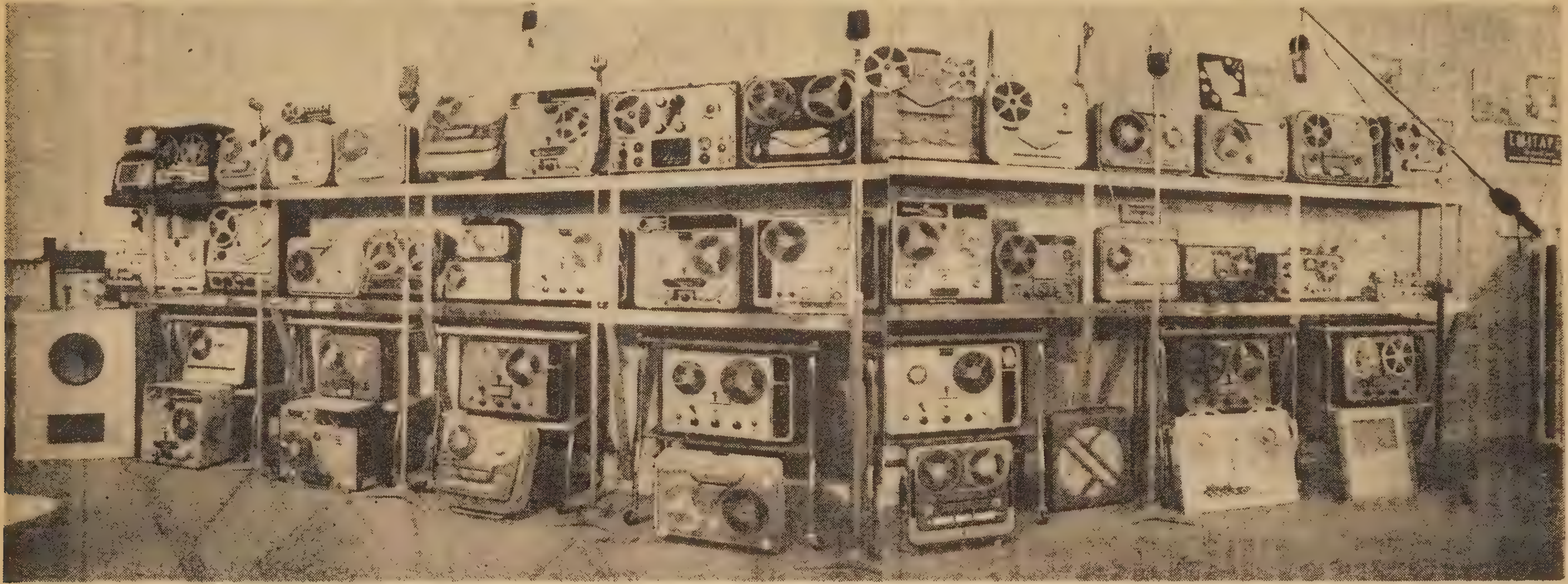

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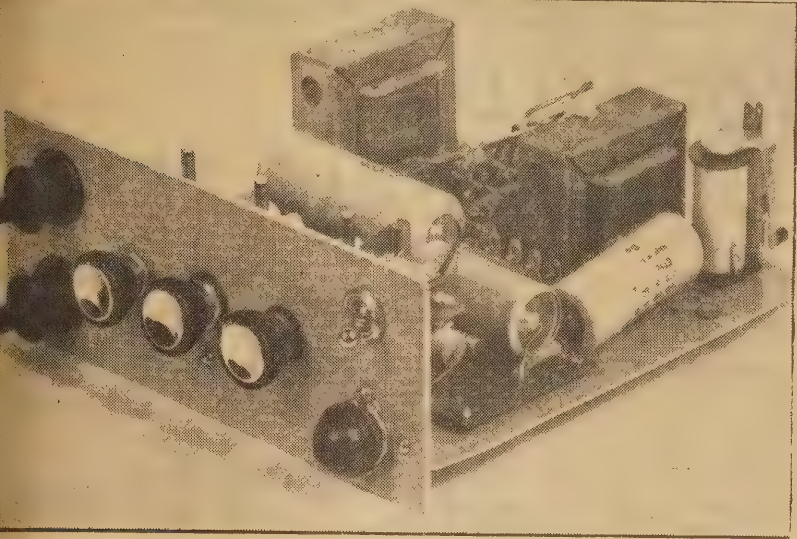

One of our experimental laboratory models of the new amplifier. Pickup and microphone inputs are to the left. Two volume controls and the tone control at the centre. On/off switch and speaker plug are to the right.

Our November issue will contain the full description of a new 10 watt public address amplifier small enough to be carried in a briefcase. Power output is sufficient to load two normal 12 inch speakers and facilities are provided for two microphones or a microphone and a pickup which can be mixed as required. Primary power consumption is only a fraction of that of previous portable PA amplifiers of this power.

ORTABLE public address amplifiers are normally designed to operate om a lead/acid accumulator and use vibrator or a genemotor arrangement convert the low voltage DC to a gher potential suitable for application the plates of valves.

Power is inevitably wasted in the conrsion process while the heaters of the lves consume energy which does not ntribute to the output. Usually less than e quarter of the input power is evenlly delivered to the speakers.

The amplifier we will describe next onth requires little current from the pply except when speech or music actually being delivered by the loudakers—even then, the current is only fraction of that required by a valve plifier.

Size is reduced in about the same protion as the current drain.

EW DESIGN

These big improvements in public lress amplifier design are made pose by the use of the latest power nsistors which work efficiently direct m the accumulator supply.

f the above reduce the primary power uirements to a fraction of that of a ator amplifier, the fact that the amer has virtually no warm-up time ns that for announcements, sports tings, etc., it need only be turned when it is actually being used. Pushlk operation is entirely feasible.

rom a heavy amplifier which requires even heavier accumulator and freit recharging, therefore, we now go to an amplifier which it is possible to operate from dry batteries.

Normally it will be clipped on to the battery of a nearby car or a small portable accumulator, in which case the total energy consumption will be so small in most cases as to be of little consequence.

Transformers in the input and output circuits of the amplifier are not necessary because transistor circuits operate at low impedance. An ordinary dynamic microphone voice coil circuit feeds directly into the first stage while a simple choke is used to couple the output: shielded input and output leads are not needed.

PRINTED WIRING

Most of the wiring is completed on a matrix board which can be handled conveniently as a separate unit. In its original form this can be handled easily and quickly but in addition lends itself to printed wiring techniques. The baseplate of the amplifier is an effective heat sink, ensuring that the output transistors do not become overheated even when the amplifier is operated at full output for long periods.

Advance information on the design has been given to component manufacturers so that you will be able to order from your usual parts supplier immediately after the November issue is published.

Clear diagrams and photographs will make it a simple matter for you to complete the amplifier, and make it perform as the original, even if you do not fully understand details of the design.

Make sure of your copy of the November issue.

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9. Dual Wave _ _ 5
10. Dual Wave _ _ 6
11. All Wave Converter _ _ _ 2
12. Portagram (A.C.) 4
13. All Wave Converter _ _ _ 1
14. "Globespan" _ 8
15. Transistor _ _ _ 1
16. " _ _ _ 2
17. " _ _ _ 3
18. " _ _ _ 4
19. " _ _ _ 6
20. " _ _ _ 7
21. Mullard 2-2 Stereo Amp
22. Twin 5 Stereo Amp
23. Twin 10 " "
24. Twin 17 " "
25. Hi-Fi 3 Amp
26. Hi-Fi 5 "
27. 13 Watt Std. Amp
28. 25 " " "
29. 35 " " "
30. Hybrid Car Radio
31. Transistor 10w Am
32. VTVM
33. R/C Bridge
34. 50 MC/S C'verter.
35. 144 " "
36. 5" Wide Range C.R.O.
37. 21" TV (Aug.)
38. M/M 1000 ohm/volt
39. M/M 20,000 ohm/volt
40. Transigram

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FROM THE SERVICEMAN WHO TELLS

A question which servicemen are often asked is whether a TV set from another country may be used in Australia, whether modifications are needed and, if so, whether they are likely to be an economic proposition. This article discusses some of the problems involved with British and American sets.

THE question may be prompted by a number of reasons. Migrants with elatives due to leave for this country wish to advise them whether they should ring their set with them, or sell it and uy a new one when they arrive. For good many reasons, to sell and re-buy ormally would involve considerably nore money than retaining an existing et, assuming it can be made to work.

Again, people intending to go abroad ften are intrigued by the prices quoted n overseas magazines and wonder vhether it would be worthwhile to purhase a set overseas — exchange rates, nport restrictions and Customs duties otwithstanding.

OUR OWN DECISION

Naturally, with all the possible variables, it is difficult to give a firm answer, ut a few facts may help in making a iser decision.

English TV is, unfortunately, just bout as far removed from our system s it can be. This is not surprising, hen it is realised that it is the oldest nd ours one of the youngest. Just about l the major characteristics are either e direct reverse or completely different om ours.

They use 405 lines, we use 625. They e positive modulation, we use negative. ey use AM sound, we use FM. Their und carrier is on the low side of the sion carrier, ours is on the high side. f seemingly lesser importance is the ct that they use vertical (aerial) polari-tion, while we use horizontal. How-er, this results in a preference for 72 m feeders, against our 300-ohm types. nally, the channels differ from ours d were more restricted in earlier odels.

NDAMENTAL DIFFERENCES

Arising out of these basic differences a number of differences in funda-ntal receiver design. The horizontal nning circuit runs at a lower fre-ency (around 10 Kc), inter-carrier nd systems are not used, the approach the AGC circuit is quite different, bandwidth of both the IF and video plifiers is only about half that of s, and the tuner may or may not be e to cope with our channels, depend- on its age. In any case, its band-lth may be restricted, and the input edance low.

ll of which does not make very mising reading for anyone contem-ing bringing out such a set and, kly, I feel that it is not normally to recommended.

lowever, I do know of a few English which have been converted to Aus-ian standards, though whether it can regarded as an economic proposition nother matter. The approach is er drastic, since it involves scrapping complete tuner and IF system and replacing them with those designed for local standards.

Although drastic, it is logical. It takes care of the channel differences, the transposition of the sound and vision carriers, the input impedance, the IF bandwidth, the FM and inter-carrier sound problems, the AGC system, and the modulation polarity. About the only thing left to do is jack up the horizontal oscillator circuits to work at 15 Kc. I understand it is worth taking a chance and retaining the original output transformer.

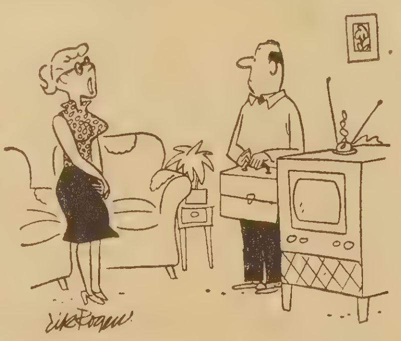
As can be imagined, a lot of work is involved, and one may be tempted to ask whether there is a worthwhile amount of original set left; whether it is too much like the "Original George Washington's Hatchet," with "five new heads and nine new handles."

To be honest, the situation is not quite that bad, since the picture tube and most of the scanning components, video amplifier, synch separator, etc., will be retained almost intact. Nevertheless, the mere physical adaptation of local components to the available space and layout would represent a lot of work, and is unlikely to be a proposition if this had to be paid for at normal service rates.

YOUR OWN TECHNICIAN

For this reason, the scheme would appear to be a practical one only if the owner was willing and able to tackle the job himself, or to employ someone who had a personal interest in the problem.

All of which is rather a pity, as far as our migrant population is concerned, but something we just have to accept as the price of progress.



"I keep getting a double image. Can either of you fix it?" (Radio Electronics)

American standards, on the other hand, are very much more like our own, even though some of this is unintentional.

Both systems use negative modulation, FM sound, horizontal aerials and, as a result, similar tuners, IF strips, and AGC systems, plus inter-carrier sound.

The differences are that they use 525 lines against our 625, 30 frames against our 25, a 4.5 Mc video bandwidth, and slightly different frequency allocations.

By a series of happy coincidences, these differences are not as serious as they may seem at first glance. Although there is a substantial difference in the number of lines used by the two systems, the difference in the number of frames almost exactly offsets this. Thus American sets have a line frequency of 15,750 cps, against 15,625 cps for our system, a difference of only 125 cps. This is well within the normal range of adjustment.

The difference in frame frequency could, in theory at least, produce a receiver in which the frame oscillator could run too fast for our standards. But in practice there is normally adequate range of adjustment to cope with this also.

The American channel numbering system differs from ours, but the actual vision frequencies used are quite close in several cases. For example their channel 3 (61.25) is close to our channel 2 (64.25). Their channel 10 is 193.25, our channel 9 196.25. Their channel 13 is 211.25, our channel 10 210.25. However, there are some gaps which would be hard to fill when all our channels are in operation.

Although the differences associated with the current channels should be within the adjustment range of the local oscillator slug, this does not automatically mean that the tuner is completely converted. There is seldom much that can be done about the RF circuits and these are not necessarily "— as broad as a barn door," as is popularly supposed.

CHECK RF CIRCUITS

In fact, they have a marked effect on the response shape, something which is easily demonstrated anytime a receiver is set up to show the overall response curve, i.e., through the tuner as well as the IF strip. Just try rocking the fine tuning control and watch the response tilt this way and that as it is moved to either side of the station carrier.

While a difference of 1 Mc on our channel 9 probably would be of little consequence the difference of 3 Mc on channel 2 is quite substantial and could hardly avoid causing some significant change in response shape.

A more serious aspect concerns the inter-carrier system. Because the sound IF is the difference between video and sound carriers, this will be 4.5 Mc in an American set, as against our 5.5 Mc which means, in simple terms, that we can receive a picture but no sound.

If we are lucky, it may be possible to re-set the existing sound IF's to this frequency. Otherwise it would be necessary either to "doctor" them to make this possible, or to replace them with local types. The latter might present a number of purely physical problems, particularly where printed wiring is used.

Finally, there is the question of operating voltage, which normally is 110 or 117 volts for American appliances. This

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means either a dropping resistor or a step down transformer, the latter being preferable for a number of reasons. This does not present any serious technical difficulty.

So, all things considered, the prospects of converting an American set are ar better than for an English type.

At the same time, I try to discourage anyone who has ideas about bringng such sets into the country. Not that have anything against them as a class, out rather because I feel that it may not urn out to be the attractive proposition hat it appears on the surface.

BELOW LOCAL STANDARDS

There is the problem of adaptation, as already discussed and, even assuming hat this is effected properly, the video bandwidth and picture resolution will not be as good as for a first-class local eceiver.

Then there is the question of service. A TV set uses a large number of highly pecialised parts, particularly windings, uch as yokes, transformers, etc., which, very often, are specially made or that particular set. What happens vhen one of these fails and cannot be epaired? One can try a similar locally nade part and hope that it might do, ut the chances are that it won't, at least ot without considerable circuit changes r seriously degraded performance.

One can probably secure a correct replacement from the makers, but who is oing to pay for the time chasing up nport licences, bank draughts, Customs learances, and all the other red tape hat goes with such dealings?

And as far as your serviceman is concerned, there is the certain knowledge hat any such set, once converted in my orkshop, will return to it with the accuracy of a boomerang every time the ightest trouble occurs. And I have no esire to tackle the job of finding replacement parts for a foreign set without the benefit of circuit, service data, manufacturer to turn to for advice.

In fact, one of my colleagues is at resent faced with just such a problem. conversion job he undertook worked ell enough at first, although there was ways the impression that picture tube ightness was barely adequate. (There as evidence to suggest that the set, pposedly new, had really had a good al of use.)

ESEARCH

This is now getting worse and he suspects a faulty picture tube, but this may difficult to confirm. The tube is a pe unknown in this country, so that first thing he has to do is secure, by me means, data sheets for it.

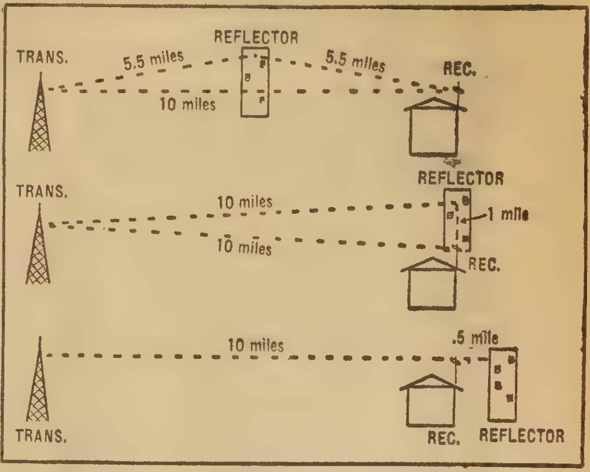
Then he will have to analyse these, eck the operating conditions in the set, d make a decision as to whether the ture tube is behaving reasonably der these conditions.

If he decides that it is not, he then es the task of finding an equivalent or ar equivalent on the local market; ding through a mass of data and lertaking a minor design problem in process. And, just to make it harder, atever he chooses will have to fit into eries heater network.

As you have probably guessed, all the egoing was prompted by an actual version case I encountered recently some of the facts that I had to dig in the process. The story started en a regular customer introduced me a friend who had recently returned from a trip abroad, bringing with him an American TV set.

Having thus committed himself — a rather risky business, incidentally —he was now anxious to find someone who could modify the set for local conditions. He seemed to have no doubt that this could be done, but I wonder what he would have said had it been an English set and I had been forced to tell him all the reasons why it could not be changed.

A "ghost" image displaced 1.8 inches to the right indicates that the signal causing it has travelled an extra mile. The object producing the reflection may occupy a variety of possible positions, however, as indicated by the sketches at right.



Quite frankly, for the reasons I have already stated, I wasn't all that keen to become involved with this one. I pointed out the various problems likely to be involved, their probable implications if things turned out unfavourably, and the fact that the set's performance might not be optimum. I also pointed out that I had not tackled such a job before, the experiences related by colleagues being my nearest approach to the problem.

NO "CURLY ONES"

Nevertheless, the owner was keen to go ahead with the job, so I finally undertook to see what could be done. However, I made the stipulation that I didn't intend to buy into any "curly ones" which might result from other-than-optimum operating conditions somewhere in the set.

If it was simply a matter of re-tuning the sound IF, touching up the channel slugs, and possibly resetting vertical or horizontal controls, then O.K. But he would have to accept the picture "as it came," along with any faults which did not respond to ordinary measures. He agreed to leave it with me on that basis.

The set turned out to be one of the semi-portable type which I understand is very popular in the U.S. as a second set; the sort of thing which the "odd man out" uses when he wants to see a program in which no one else is interested. It used a 14in picture tube, was built in a metal case, and used transformerless circuitry. While the latter arrangement saved a good deal of weight, I still would not like to carry the thing very far.

Fortunately, I had a 110-volt transformer available for testing, so I was able to put the set into operation without delay. Using channels marked 3, 11 and 13, I was able to tune in all three local channels without any great difficulty. Both horizontal and vertical oscillators locked immediately and, strangely enough, the fine tuning control seemed to be pretty close to the mark. I can only assume that it must have been in need of adjustment as far as its own channels were concerned.

The picture quality was what might be termed "acceptable"; nothing startling, but no worse than some local efforts I have seen. Considering that it was only a 14in set, I imagined the owner would be happy enough with it.

That much established, I switched off and removed the back. The set used a vertical chassis with a hole through the centre to accommodate the neck of the picture tube. The major components were outermost and the wiring—mostly printed wiring—hidden on the other side.

Nor was this particularly easy to get at. The makers obviously didn't believe in wasting money on such refinements as plugs and sockets, so that the yoke was wired directly into the chassis. The picture tube leads had a socket, but this didn't help much, because I couldn't run the set with it removed, due to the series filaments.

All I could do was ease the chassis part way out of the cabinet at an odd angle and try to see around corners in an effort to locate the ratio detector components. I eventually found a small electrolytic in this part of the chassis and assumed that it was the one I was after. Anyway, I clipped a pair of voltmeter leads across it on spec.

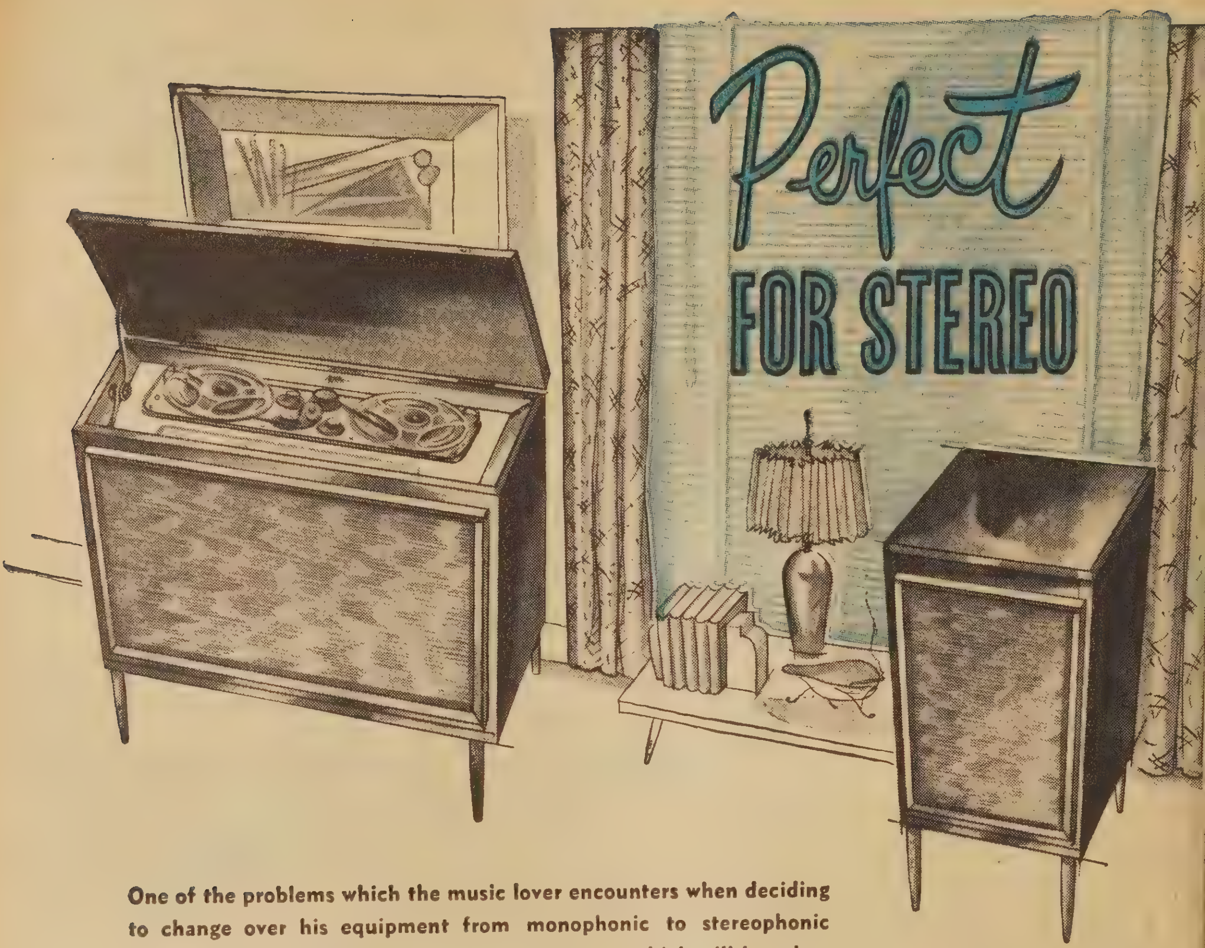
Next I set up the signal generator to give 5.5 Mc and sought a suitable place to feed it into the system. Partly because it was easily identified and partly because it seemed likely to provide reasonable isolation, I selected the grid of the video amplifier.

CIRCUIT DETAILS

There was only a single IF sound stage, preceded by a single tuned winding and followed by a conventional ratio detector transformer, making three windings in all which had to be shifted in frequency. Would they all have enough range to reach 5.5 Mc?

The first two windings peaked up without difficulty, although the first one only just made it. Then I transferred the meter to the centre tap from which the audio output was taken and adjusted the third core for DC balance in the normal way. It seemed that luck was with me.

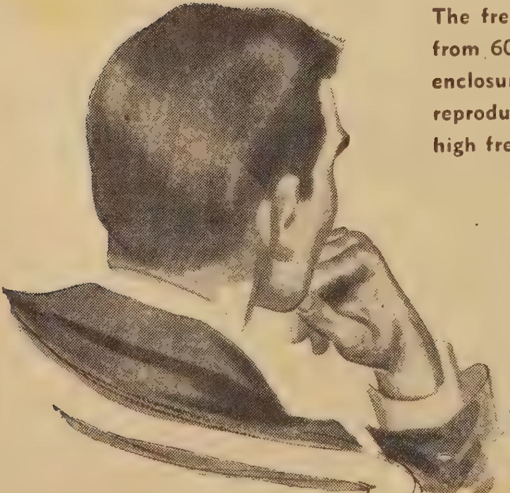
Of course, it may have been possible



One of the problems which the music lover encounters when deciding to change over his equipment from monophonic to stereophonic reproduction is the amount of living-room space which will be taken up by an adequately baffled loudspeaker for the second channel. Besides seriously encroaching on the floor area, the conventional size enclosures required for 12 inch loudspeakers also introduce placement problems which can prevent good stereo reproduction. It was to overcome these drawbacks that Rola developed the new 8 inch Model 8MX and designed a compact enclosure for use with it.

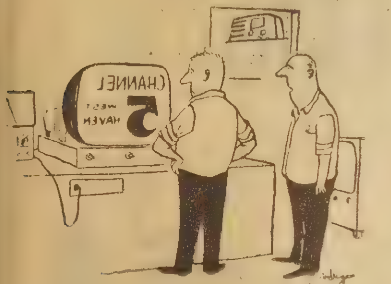
The frequency range of the 8MX is conservatively stated to extend from 60 cycles per second to 10 K.C., but when used in its special enclosure—its capacity is less than 2 cubic feet—the 8MX adequately reproduces the full tonal range from the organ's deep notes to the high frequencies of the cymbals, triangles and maracas.

Full details of the 8MX and constructional information on the Rola-designed vented enclosure for use with it are available, free and post free, from the Sales Department, Rola Company (Aust.) Pty. Ltd., The Boulevard, Richmond, E.1, Victoria.



to reduce any existing "C" across the windings, or even doctor the windings, but both would have involved a fairly major operation. In addition, there is the risk that a ratio detector transformer designed to give an optimum "S" curve under one set of conditions might behave quite differently once its operating conditions have been altered.

To be sure, it probably still will "detect," but whether it will be linear over the required deviation, or whether it will have maximum AM rejection is another matter. As far as that goes, the mere changing of frequency could create similar problems, though probably to a lesser extent.



"Try reversing the plug!"

If it should transpire that these effects were serious (such as excessive frame buzz due to poor AM rejection) it might be necessary to fit a locally made winding; a job which could present its share of purely physical problems on a printed wiring board.

On the other hand, the gated beam-type FM detector, which seems to be gaining in popularity, is far less critical in this respect. There is no balanced ircuit to worry about, only a pair of onventional tuned circuits; one in the ormal (input) grid circuit and one conected to the quadrature grid. Both are imply peaked to 5.5 Mc.

At this point I faced another problem. n theory, at least, the video amplifier rap circuit also should have been hanged from 4.5 to 5.5 Mc. But, quite rankly, the construction of the set was uch that I was unable to locate this vinding without going through the comlex process of getting the chassis right ut of the cabinet.

/IDEO RESPONSE

My impression is that a video amplier designed for a nominal 4.5 Mc video hannel—particularly in a small, low ost set of this kind—would have a relavely poor response anyway. More than kely it was well down the drain at 5.5 Ic without the benefit of any trap.

So I took a good look at the picture r signs of 5.5 Mc herringbone, was nable to find any, and decided that this peration could be neglected; at least as r as this particular set was concerned. However, it must not be overlooked at in some sets the sound IF is taken om the trap circuit, either in the plate cathode of the video amplifier. The ea is to use the gain of the latter for e sound IF. In such cases, and assumg the circuit depended on this gain, e adjustment of the trap might be more portant.

It might also be asked whether anying should be done about the video alignment since (again, in theory) ere would be no sound plateau 5.5 Mc ay from the vision carrier. However, the fact that the thing worked proved that there must have been enough response at this point, and I certainly didn't intend to buy into alignment problems of that order, particularly without a circuit or service data of any kind.

And so the set went back into its case and was given a final check for overall performance. A few days later, when a suitable 110-volt transformer had been delivered, I passed it on to the owner. He was very happy with the whole transaction and fussed over the set like a kid with a new toy, but I couldn't help wondering what was going to happen if the line oscillator transformer blew its top sometime and there was no local replacement for it.

Still, I'll worry about that when it happens.

Last month I dealt with a couple of popular misconceptions expressed by TV viewers, which I felt were interesting, if only for their humour. However, even among those more closely allied to radio and TV, it is still possible to find some funny ideas which are treated as gospel. A discussion between a couple of students which I happened to overhear started this line of thought.

LOCATION OFF SCREEN

The subject concerned TV ghosts and the possibility of locating the reflecting object by taking measurements from the TV screen. The general idea seemed to be that one simply measured the image displacement, fed the value into some kind of formula involving the speed of radio waves, and come up with an answer in miles. Then one simply drew a circle around the receiving point on this radius and picked out the most likely object which it happened to intercept.

They both seemed agreed that this could be done, it being mainly the method that was in doubt. One claimed that the answer obtained was correct as it stood, while the other maintained that it should be halved, since the signal had to go to the reflecting surface and back again.

Well, I hate to spoil a good story, or deflate our budding mathematicians, but the truth is that neither is right, and mathematics just aren't that good. Let's take a closer look at the problem.

If we take the speed of radio waves as a round figure of 186,000 miles per second, we can calculate that a signal will travel one mile in 1/186,000 sec., or 5.4 microseconds to use a unit more common to TV calculations. This figure of 5.4 uS/mile may be regarded as a constant, regardless of the TV system used.

Next, let us look at the receiver. Operating on Australian standards, the set produces 625 lines per picture and 25 pictures per second, or 25 x 625 equals 15,625 lines per second. Once again we convert to microseconds, (divide 15,625 into 1 million) and we get 64 uS as the period required to scan one line.

However, about 12 uS are "wasted" in the blanking and pulse period, leaving 52 uS for actual picture information. (This assumes no horizontal overscan but overscan does, in fact, almost always occur.) By taking a few liberties we can say that the signal will travel one mile in the time taken to scan approximately 1/10 of the screen width.

(Continued on Page 117)

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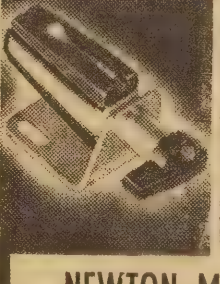

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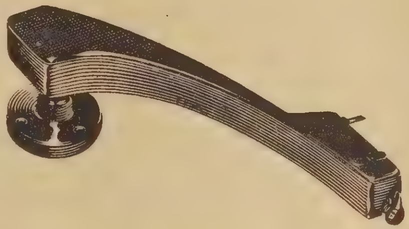

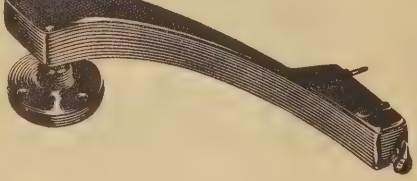

HGP38 A Crystal pick-up. Incorporates the HGP37 turnover cartridge for standard or microgroove recordings with cantilever stylus.

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GP66: Series of lightweight pick-up with die cast arm construction increasing torsional rigidity, minimising arm resonance. Complete (with GP65-1 or GP65-3 cartridge).

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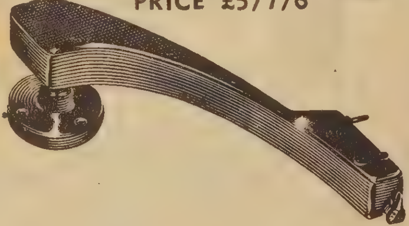

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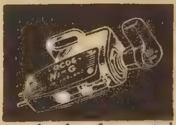

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GP65 Turnover crystal cartridges available in two types, medium output High Quality or High output.

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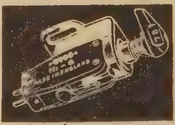

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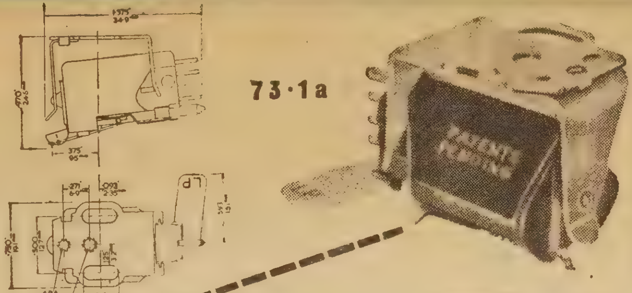
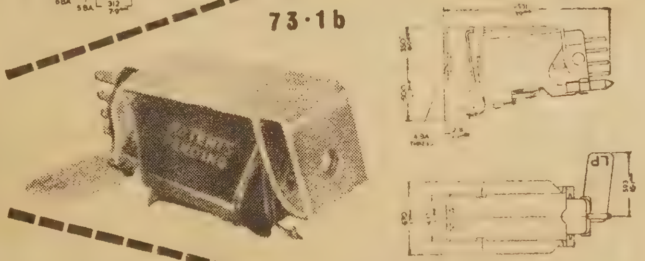
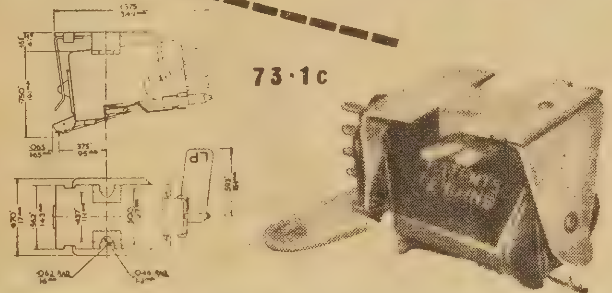
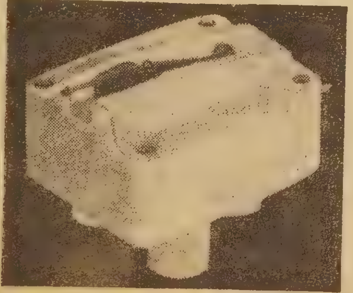


73·1b



73·1c



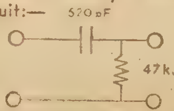


acos

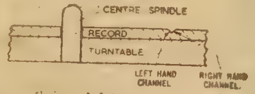
Crystal stereophonic cartridge

The "ACOStereo" 73-1 is a universal cartridge designed to play stereophonic and monophonic discs, including 78 r.p.m. coarse groove records. Three brackets are available. The "a" bracket fits the majority of arms, the "b" bracket fits Garrard RC. 110 and RC. 120 changers, and the "c" bracket is intended for American arms of the VM type.

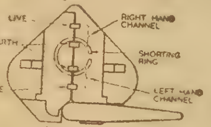
The output from the "ACOStereo" 73 is flat when fed into a 2Megohm impedance. If record compensation is available in the amplifier, it is advised that the output is converted to constant velocity characteristics by feeding through this circuit:—



The left-hand channel is defined as the channel reproduced by the left-hand speaker when viewed by the audience, and is recorded on the left-hand groove wall when the record is viewed as:—



The "ACOStereo" cartridge connections as seen from the rear:—

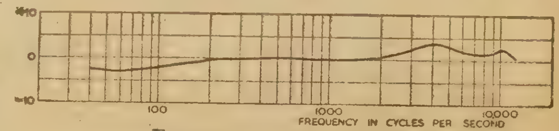


The shorting ring should be removed for use with amplifiers requiring separate leads.

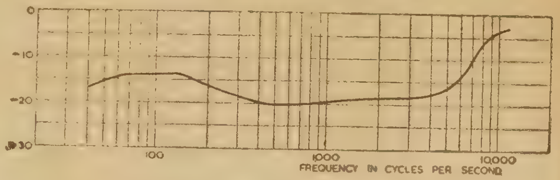
PERFORMANCE OUTPUT — 160 m.v. at 1 cm/sec.
Average — 300 mv.

FREQUENCY RESPONSE—
40—12,000 c/s.
SEPARATION between channels at
1 K/cs better than 20dB.
Radii of Stylus tips—0.0005" (13.5 microns).
0.0025" (62 microns).
Recommended load: 2 Megohm
(Compliance equals 3.5 ucm/dyne).
(Stiffness equals 0.0286 x 10 dynes/MM).
Recommended downward pressure: 3-4 Grammes.

The Stereo recording characteristics is within ½dB of the RIAA/BS 1928/1955 characteristics, and cross talk is better than — 20db at 1 K/cs.



Frequency response on PS.131.



Separation between Channels on PS.131.

The response of both channels will be within 3dB.

All 73 series cartridges are available with two sapphire, sapphire and diamond or two diamond styli.

Prices: 73 series — Cartridge incl. 2 sapphire styli, £5/15/-; with sapphire and diamond styli £11/18/6; with 2 diamond styli £15/19/6.

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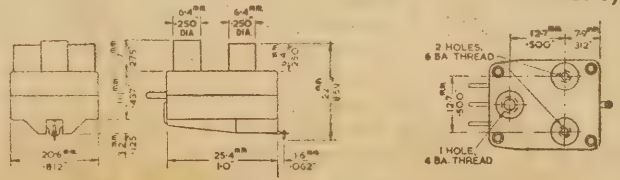

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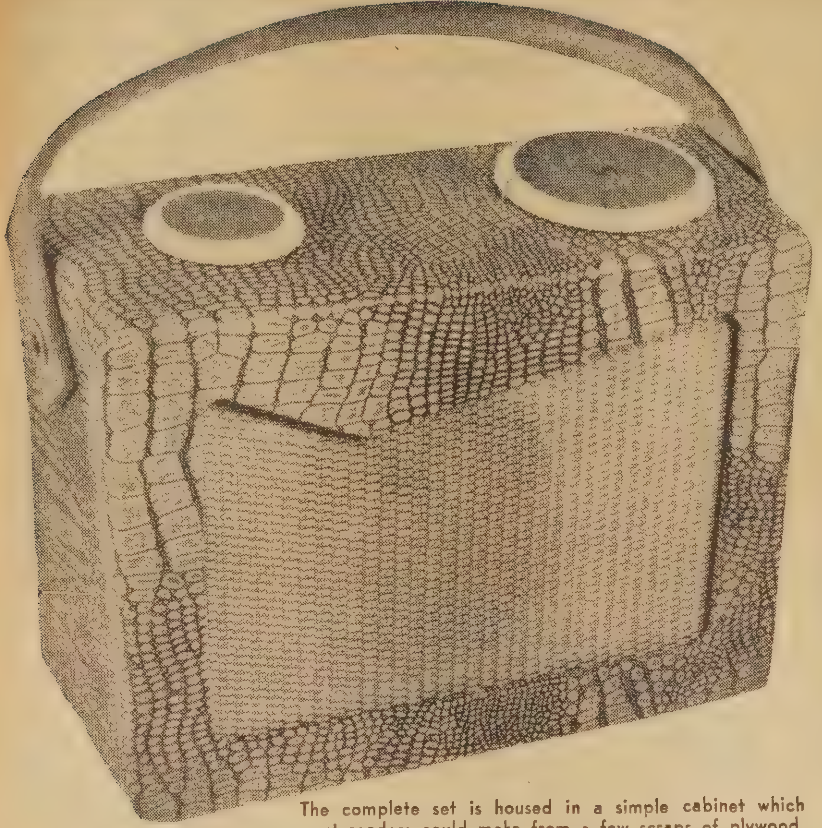


The complete set is housed in a simple cabinet which most readers could make from a few scraps of plywood, finished with leatherette or a glossy enamel. Note the slim style knobs which are simple "push on" types.

Building A Transporta Four

In the May, 1959 issue we described a four stage transistor superhet and suggested that it would appeal particularly to the experimenter. Here is a description of a modified version using commercial components since made available. By simplifying the construction these should widen the set's appeal considerably, making it a simple little portable in its own right.

by Philip Watson

WHEN we described the original circuit we intended the project mainly as an experimental one, particularly for those readers who are keen on small sets. In many ways it was a logical follow up of the small three-stage design in the previous March issue, coupled with the front end of the Transporta. At the time we did not have very strong ideas about the set being regarded as a full-scale project.

However, it does appear to have acquired sufficient popularity to encourage manufacturers to produce special components for it, thus more or less establishing as one of the Transporta series. Provided that the limitations of a small set of this kind are fully appreciated, there does appear to be a place for it in the scheme of things.

TRUE SUPERHET

As distinct from smaller sets, it is a true superhet and thus does not suffer from many of the limitations of two and three stage designs .Admittedly, there is no IF amplifier stage, but this is offset to a large extent by the use of regeneration at the intermediate frequency, providing a worthwhile improvement in both gain and selectivity.

By shifting the regeneration to the IF circuitry, this function is rendered largely independent of station strength or frequency, at least to the extent that it becomes perfectly practical to set the regeneration to an optimum level and then forget about it.

As a result the set is capable of quite an impressive performance, for its size, without being in the least bit fussy to tune. The regeneration control is a screwdriver adjustment on the chassis and the only controls needed by the user are the conventional tuning and volume knobs.

The power output, although limited to about 50 milliwatts, can make quite a lot of noise when fed into a modern speaker, and is perfectly adequate for personal listening in an ordinary room.

In fact, the set appeals to us as an ideal personal set for a teenager to use in his or her own room or den. It will receive all the local stations on its own aerial, makes enough noise (yet not so much as to disturb the rest of the household), needs no power point, yet costs so little to run that no one need worry on this score.

And, when one comes to think about it, that is about all the average listener needs anyway.

PRINTED WIRING BOARD

The most important new component is a printed wiring board to replace the simple sheet of punching bakelite we used in the original. Its use will save a good deal of time, as well as simplifying the construction considerably. It is made to fit in the same space allocated to the original sheet.

To go with this is an IF transformer fitted with a feedback winding, mounted in a standard miniature can, and designed to mount directly on the printed board.

The original IF transformer was hand wound on a ferrite ring (toroid) and there is no doubt that this represents about the ultimate in efficiency. Also, in the absence of a commercial unit, it was a relatively easy way to provide the winding we needed. However, at our suggestion, the manufacturers have gone to a good deal of trouble to provide a high order of efficiency in the new un and, remembering that the regeneratio will make good most of the losses an way, the difference in the final result negligible.

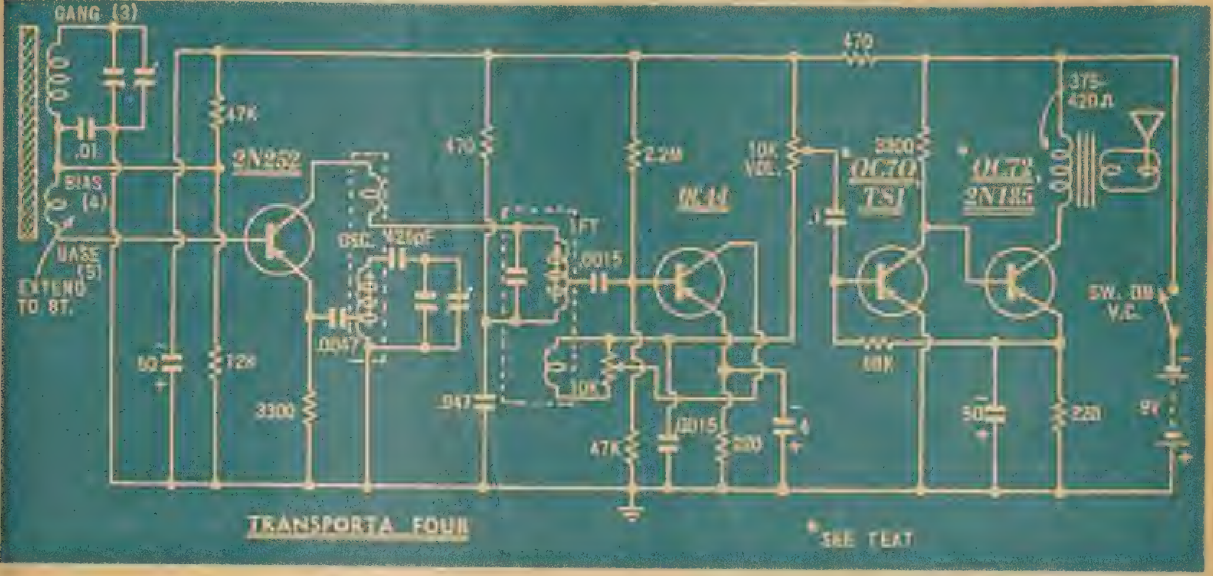
A third new item is a set of tuning ar volume knobs which, in addition to b ing in a very attractive style, elimina the need for an extension shaft on t gang. They are of the simple "pus on" variety, yet grip the shaft qu positively.

SIMPLE JOB

The printed board makes the act assembly and "wiring" so simple that venture to suggest that anyone who c tell the difference between a resistor a a capacitor and can read the colour c should be able to do the job without e referring to the circuit.

The board carries the actual "wiri on the underside, and a coded pattern top which indicates the exact position each component. Thus, by reference an accompanying code sheet the app priate component mav be selected,

SUPERHET "FRONT-END" AND REGENERATIVE DETECTOR



The circuit employs a frequency changer, regenerative detector, and two stage direct coupled audio system. The latter is designed to be free from temperature effects without the use of special components. The 10K pot. is the pre-set regeneration control.

igtails pushed through the holes, rimmed, and soldered into place.

In theory, at least, the job is complete vhen all the components are used and all he holes occupied!

Particularly in regard to the smaller omponents, it would appear to be unvise to mount them hard against the viring board. Such an arrangement nakes no provision for mechanical stress, ocates the soldered joint unduly close o the component, and makes subsequent emoval rather more difficult.

In addition, it will be found that a mall amount of sideways movement ften is necessary to clear other comonents, mounting bolts, etc. For this eason we suggest leaving a clearance of p to ¼in. The transistor leads are best eft untrimmed.

In the case of the coils, gang, and tab ot., there is no doubt as to the orientaion and, in fact, the coils can be mountd only one way. The coils and the tab ot. are secured by bending the mountng lugs over as far as possible, then solering to the copper pattern.

VATCH FOR SHORTS

The gang is mounted with four nuts nd bolts and the only precaution here oncerns the bolt nearest the N252 transistor (36). This area rather crowded, and there is risk that a standard size nut may reate a short circuit. Simply reverse ne nut and bolt positions, placing the ead of the bolt on the underside.

Since the final alignment adjustments ill have to be made after the set is tted to the cabinet, it would be a help the trimmers could be mounted so aat they are readily accessible. Not all pes will be suitable in this respect, but is worth keeping in mind. Alternavely, two small inconspicuous holes may provided in the side of the cabinet.

In the case of some of the capacitors, iginally specified as paper types, it has een found advisable to change to the more compact ceramic types in order to accommodate them in the available space.

While on the subject of capacitors, some of the smaller electrolytic types have been causing our readers bother, due to the difficulty of determining the correct polarity. We must admit that a few do leave much to be desired, having no distinguishing marks and being the same colour (often red) all over.

A reasonably accurate guide is that the end which has fairly obviously been sealed, i.e., is slightly smaller or crimped, is the positive end. However, if possible, reject unmarked types in favour of those which are clearly marked.

As we mentioned in the previous article, the performance of the ferrite aerial is noticeably improved by increasing the number of turns on the base winding from the usual five to eight. There normally is enough wiring in the flying lead to provide the extra turns, and this may be made good with an extra length of fine wire, or it may be joined directly to the earthy end of the tuned winding at the most convenient point. A length of light plastic sleeving over each lead will help protect it.

To avoid any confusion which may result from varying terminology associated with the aerial winding, we have included the wiring board terminal numbers in the circuit diagram and prepared a small diagram showing how these relate to the physical layout of the winding.

The chassis requirements are substantially the same as before, and the original drawing is still valid. However, a few minor variations may be required, mainly in regard to the mounting holes for the printed board. These are best determined from the board itself and it should be noted that, of the alternative sets of holes at the rear, those closest to the rear edge should be used. The other set is too close to terminals or components.

PARTS LIST

1	Cabinet internal clearance measurements 8 3/8 x 6 x 3 inches.
1	chassis, 8¼ x 5½, with a 4 7/8 x 2 inch fold-over.
1	ferrite rod aerial. (See text re modification).
1	5 x 4-inch high sensitivity speaker
1	output transformer, 375 to 420 ohm load.
1	2-gang miniature (Roblan), 420 approx. pF.
2	50 pF trimmers.
1	oscillator coil, as for "Transporta."
1	calibrated tuning knob.
1	volume tuning knob.
1	printed wiring board (No. 569 or similar.)

TRANSISTORS

1 2N252, 1 OC44, 1 TSI, 1 2N185.

CAPACITORS

2	50 mfd 12 volt electrolytics.
1	4 mfd 3 or 6 volt electrolytics.
1	.1 mfd 100 volt ceramic.
1	.047 mfd 100 volt ceramic.
1	.01 mfd 100 volt ceramic.
1	.0047 mfd 100 volt ceramic.
1	425 pF mica, close tolerance.
2	.0015 mfd ceramic.

RESISTORS. All ½ watt.

1	10K potentiometer with switch, low hop-on resistance preferred.
1	10K potentiometer, tab mounting with screwdriver adjustment.
1	2.2M, 1 68K, 2 47K.
1	12K, 2 3300 ohm, 2 470 ohm.
2	220 ohm.

SUNDRIES

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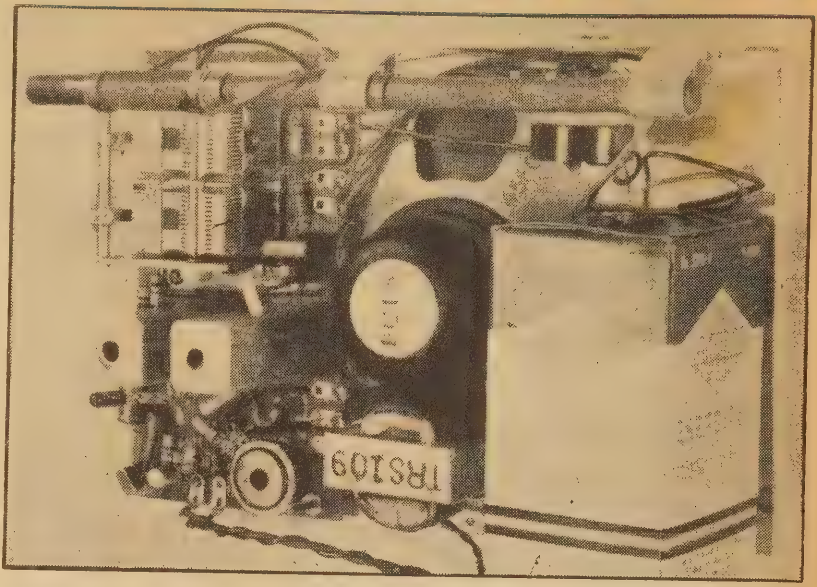
LAYOUT OF COMPLETE SET



This photograph shows the complete set ready to slip into the cabinet. The methoo of mounting the ferrite rod is clearly visible. Note the standard IF transformer in place of the ferrite ring.

Also, a slight easing to the left (away from the speaker) may be helpful, but leave enough clearance on the edge of the chassis to permit the fitting of a chassis-to-cabinet mounting screw. Four countersunk screws are used to support the board, using extra nuts to raise it above the chassis by the required amount. This should be no more than sufficient to clear the speaker.

We are not sure at this stage whether a ready-made chassis will be available, but it is not a difficult job to make this up from the accompanying drawing. It is little more than a plate, with only one simple bend, and may be made from a scrap of 18-gauge aluminium. The rectangular cut-out under the printed board is not essential, being mainly to provide access in the event that components have to be changed

CABINET

In the matter of the cabinet, there are not, as far as we know, any commercial versions of this design available. Past experience has shown that commercial cabinets are fairly expensive items, and, while the superior finish may be justified in the case of a more elaborate set, the cost may be prohibitive in the case of a simple set built to a budget. For this reason we feel that most builders will prefer to make their own.

If so, we suggest that the chassis be made first and the cabinet cut to fit it, remembering that an extra 1-32-inch on purely nominal dimensions often can make the difference between a chassis that slides into place easily and one that has to be forced and wangled.

A possible alternative is to use a cabinet designed for the Transporta Seven, particularly as we understand that there are a few polished wood versions of this being offered around the trade at a reduced price. One suggestion is that this simple set may eventually provide a basis for a Transporta Seven, many of the parts being similar or identical.

CHECK CAREFULLY

If you have ideas along these lines it would be wise to acquaint yourself with the cabinet first, since a number of minor problems may have to be solved, particularly in regard to supporting the small classis in this larger cabinet. It may well be that a larger chassis will have to be provided to overcome this.

We have had no opportunity to investigate all these problems ourselves, and we simply pass the idea on for what it is worth. It will be up to the individual to decide whether he can make use of it.

As we emphasised in the original article, much of the success of 2N185 as a single-ended output stage depends on the use of a high sensitivity speaker. Anything smaller than a 4 by 5 oval type and with a large magnet, such as the Rola type F, is likely to give disappointing results. Larger speakers would be even better, but, quite obviously, are difficult to accommodate.

The speaker transformer is readily available, being the same type as used for the Transporta Seven, with the centre tap ignored.

The placement of the ferrite rod is fairly important, otherwise there may be difficulty in fitting the chassis into the cabinet. The brackets are made from small strips of aluminium about ½in wide and 3in long, one end being wrapped around the rod and the other fastened to the upturned portion of the chassis with countersunk bolts.

However, do not, in any circumstances, be tempted to use the ferrite rod as a former around which to bend the straps. It is extremely brittle and very easily broken. A piece of ⅜in brass rod held in the vyce will do the best job.

Do not completely encircle the rod (making a shorted turn) and do not make things so tight that there is any risk of breaking the rod while fitting it. A sliding fit is better and a couple of rubber bands wrapped around the rod will prevent it from falling out.

The brackets are set at a slight angle (about 30 degrees) where they meet the chassis, so that the rod is moved back about 5/16in and is about 2½in from its centre to the main chassis. The main requirements are that it allows the chassis to be fitted into the cabinet, is clear of the gang throughout its rotation, and does not foul the back of the cabinet. The brackets are so spaced that about 4in of rod is available for adjustment of the winding.

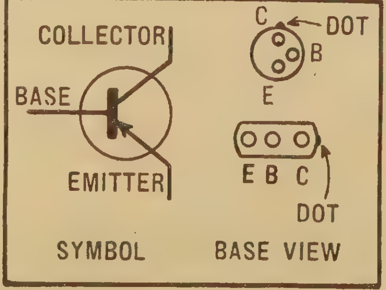


Diagram showing the two most common lead arrangements for transistors. Check carefully to ensure that these are correctly connected

The volume control should be fitted with spacing washers so that virtually no thread protrudes beyond the securing nut. This is necessary to enable the "push-on" type of knob to sit close to the top of the cabinet. Cut the shaft length to about 5/16in for this type of knob.

It may be necessary to leave about 1/16in clearance between the top of the cabinet and the chassis to assist in this regard, and this point should be checked before the chassis is secured. Mounting is by means of small wood screws which enter the front of the cabinet surrounding the grill. Select their length with care or use washers to ensure that they do not come through the wood or covering.

LARGE HOLES

Fairly large holes may be cut in the top of the cabinet, since they will be hidden by the knobs. This will allow clearance for the volume control nut and also assist in the fitting of the chassis by allowing it to be slipped in at an angle.

When all the assembly has been completed and the various sections — speaker, volume control, aerial, etc. — connected together, the set will be ready for a trial run. It would be wise to fit a milliamp meter in the 2N185 collector lead and check the standing current. Any circuit abnormality which causes excessive current may damage this transistor if the overload is prolonged.

In particular, the TS1 and its associated circuitry should be checked, since anything which causes this to draw too little current can create this condition. A faulty TS1, a faulty 3300 collector resistor, or a faulty 68K base resistor, could be responsible. More likely, the TS1 may be connected incorrectly, with

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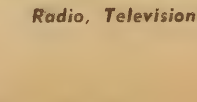

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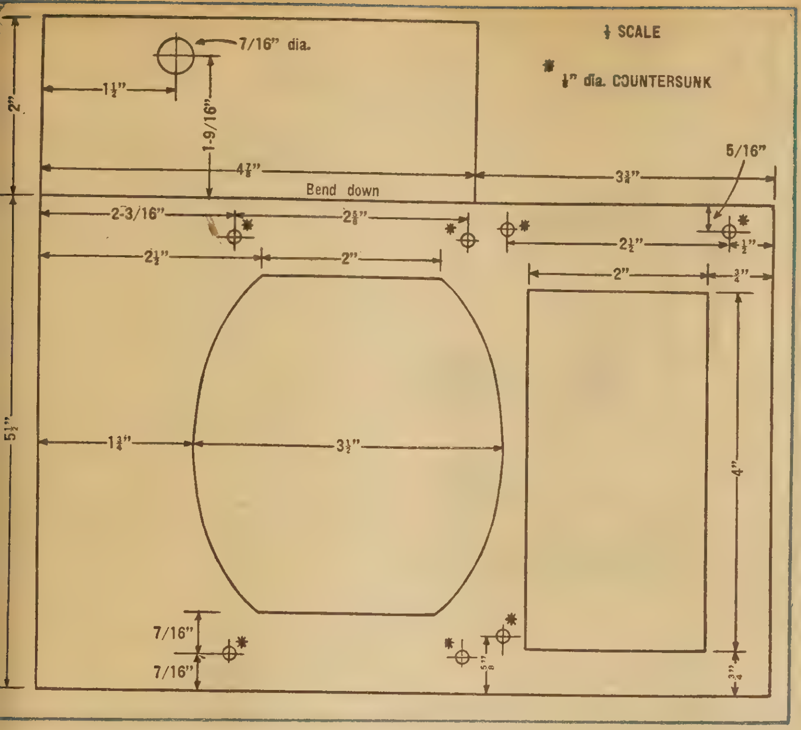
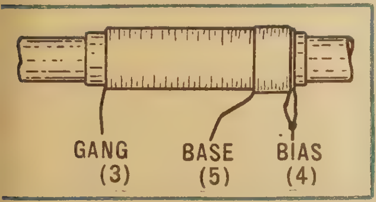


The chassis may be made from a small piece of 18 gauge aluminium cut and bent to the above dimensions. Note that the holes associated with the printed board may need to be modified and the exact position should be checked with the speaker in position.

he base and emitter reversed: a simple enough mistake if you are unfamiliar with these connections.

We were able to add to the previous ests we had made on this circuit by obaining three TS1s with Beta values of 0, 15 and 20; representing minimum, entre and maximum figures respectively s set by normal tolerances.



This diagram should prevent any confusion concerning the aerial coil leads. Numbers refer to the numbers on the printed board.

Beta 10 gave a TS1 collector current f .72 mA and a 2N185 collector curent of 25 mA. Beta 15 a TS1 current f .95 mA and a 2N185 current of 2 mA. Beta 20 gave 1.15 and 20 mA. espectively. Fairly obviously, the Beta 5 condition would be closest to the leal.

All these 2N185 currents are well ithin the maximum dissipation rating f 150 Milliwatts, but the figure of 25 nA may be unnecessarily heavy on the attery. If a figure as high as this is ncountered it would indicate a TS1 little on the low side (though within lerance) and we suggest that the 68K S1 base resistor be modified slightly. n our case a 47K raised the TS1 curent to .88 mA and reduced the 2N185 22.75 mA. A 39K gave 1.1 mA. and 20 mA. and something around these values should suit in most cases.

It should be noted that these figures were taken on a fairly cool day and that the 2N185 current will decrease with increase in temperature, due to the protective feature of the direct coupled circuit. For this reason, readings made on a hot day could drop by several milliamps.

As shown on the circuit, an OC70/OC72 combination may be substituted for the TS1/2N185 arrangement. The only circuit change is to increase the OC70 base resistor from 68K to 82K.

When all is well in this respect the set may be left on and a search made for stations. It is likely that one or two of the stronger ones should be heard. If necessary, advance the 10K regeneration control (clockwise from above the board) and, when a signal is heard, it should be possible to advance this until the set goes into oscillation. Even without a signal, the presence of oscillation can be detected by a substantial increase in noise level. For the moment advance it as far as possible without causing actual oscillation.

Having established that the set is working, the IF transformer should now be adjusted to 455 Kc. Although the exact frequency is not absolutely essential, its use does assist tracking and minimises spurious heterodynes. A simple and very effective way of feeding the signal into the system is to clip the active generator lead on to the metal case of the 2N252. Only one tuned winding and one slug is involved, making this a very simple procedure.

To adjust the oscillator and aerial circuits, use may be made of either generator or broadcast station signals.

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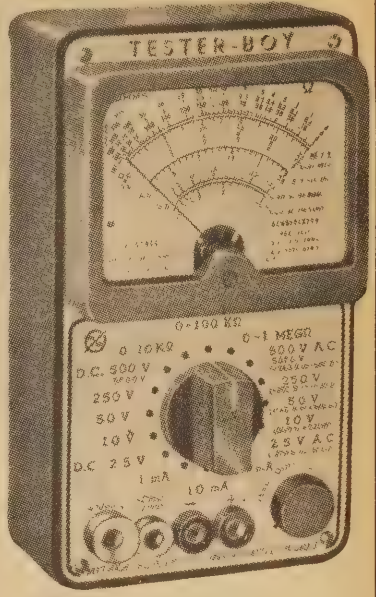

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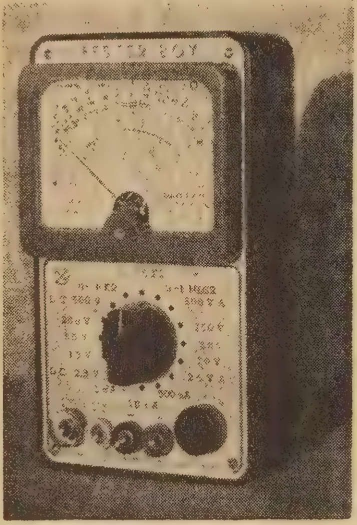

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OC72 ..	**£3/6/6 pr.**	2N252	**£2/3/-** ea.
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If a generator is used, signals may be fed in by means of a couple of turns of wire looped around the ferrite rod.

In any case it will be necessary to fit the tuning dial and improvise a temporary pointer of some kind to serve as a reference. Close the gang and set the low frequency end of the scale opposite the pointer. Tune in a signal around 600 Kc and adjust the oscillator core until calibration is correct. Then slide the aerial coil along the ferrite rod until maximum signal strength is obtained.

At the high frequency end of the dial select a signal around 1300 to 1400 Kc and use the oscillator trimmer to adjust the calibration and the aerial trimmer to give maximum strength.

REGENERATION

At this point it will be necessary to reset the regeneration, which probably will spill over on strong signals. Using the strongest signal, advance it as far as possible without causing actual oscillation. After this it would be wise to repeat the adjustments already described at 600 and 1400 Kc.

In the normal way this would complete the alignment but, in a small set of this kind, it is worthwhile checking the tracking around the middle of the band since any error here will restrict performance. This is done by simply tuning in a suitable signal and checking whether it can be improved by adjustment of the aerial trimmer. Any significant improvement represents a tracking error. This should be confirmed by a calibration error on the dial.

In fact, we are not completely happy about the padder value to specify for this circuit. The components were originally designed for a 390 pf padder, but we have consistently found it necessary to use at least a 425 pf, with the suggestion that it could profitably be increased to 470 pf in some cases. Time has not permitted us to investigate the exact cause of this anomaly, but it does appear that there is room for experiment.

ADJUSTABLE PADDER

One idea is to use an adjustable padler and, while a little unconventional, s perfectly legitimate where we want to get the most out of a small set. The alignment procedure now is to adjust the oscillator and aerial cores at the low requency end, the padder in the centre of the band, and the trimmers at the high requency end.

There will be considerable interaction between the padder setting and the oscilator slug, so that a number of experimental adjustments will be necessary to et the best results. Start with the padder crewed well in or, better still, set on a ridge to about 425 pf.

Most adjustable padders are a good eal larger than the fixed padder allowed or on the printed board, but it can be ccommodated without difficulty by fitng a pair of pigtails and allowing it to verhang the board in the direction f the speaker. In addition to improving he sensitivity at the centre of the band, nproved tracking also helps to minimise purious heterodynes which might otherise be encountered in the presence of ery strong signals.

Which just about covers all the points ou will need to know to get this simple tle set working. We think you will et a lot of enjoyment out of building and using it.

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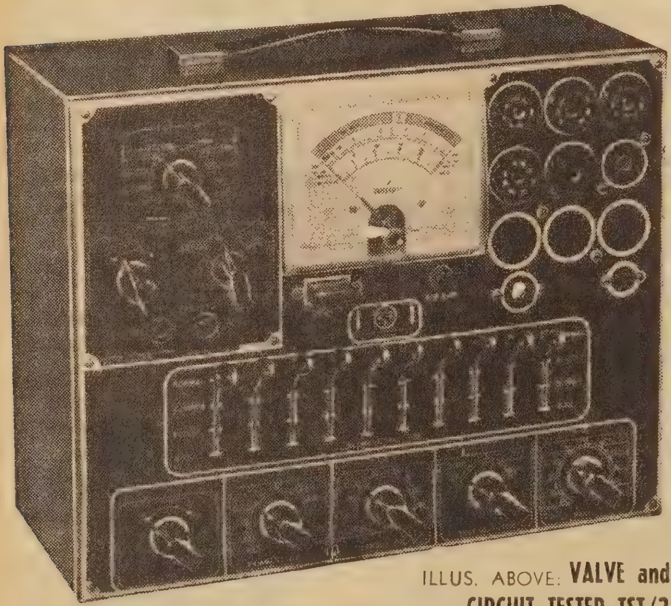

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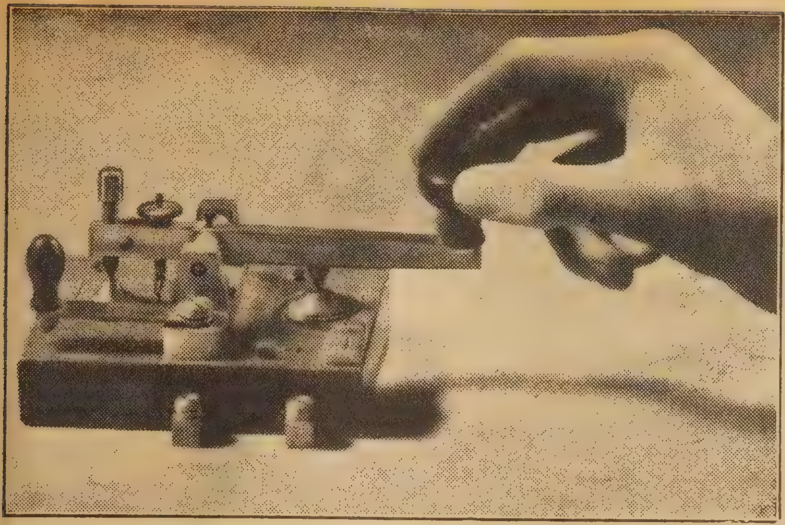

This is the recommended way of holding the Morse key. It is a good idea to get someone to send for you before you attempt to practice sending yourself.

How to Learn the Telegraphic Code

In past issues we have featured model answers to the theory section of the examination for the Amateur Operator's Certificate of Proficiency. For the general class certificate you must also be able to send and receive Morse Code at a speed of 14 wpm. This article, written from practical experience, is designed to help you master the Code.

THE Morse Code is essentially a sound language. Therefore, the only way learn it is by sound. It follows that e "opposites" method and others of milar type are not the best. By their se, the student learns to "see" Morse mbols and pictures so many dots and ashes on paper, instead of relying on e rhythmical sound of each character.

He is then faced with the necessity of nverting his visual picture into a sound icture before he can achieve any real eed. The logical thing is to concentate on sound right from the start.

Before attempting to "take" Morse or nd it, the student must first memorise e code.

SOUND LANGUAGE

In this article, the full code is set t and you will note that the letter elf is written after the actual sound.

The student should learn that "d' dah" eans "a" and not that "a" is "d' dah."

Start the job of memorising the code singing each letter, then say the letter.

g.,

"d dah" — "a."

"dah d' d' dit" — "b."

"dah d' dah dit" — "c."

Dashes are called "dah" and dots are lled either "d'" or "dit," depending their relative position in the symbol.

MORSE ALPHABET

SOUND	MEANING
d' dah	A
dah d' d' dit	B
dah d' dah dit	C
dah d' dit	D
dit	E
d' d' dah dit	F
dah dah dit	G
d' d' d' dit	H
d' dit	I
d' dah dah dah	J
dah d' dah	K
d' dah d' dit	L
dah dah	M
dah dit	N
dah dah dah	O
d' dah dah dit	P
dah dah d' dah	Q
d' dah dit	R
d' d' dit	S
dah	T
d' d' dah	U
d' d' d' dah	V
d' dah dah	W
dah d' d' dah	X
dah d' dah dah	Y
dah dah d' dit	Z

For example, if a symbol ends in a dot, the dot is called "dit." If the dot precedes a dah or another dot, it is called "d'."

The object of this treatment is to give the impression of the sound and rhythm of the code by means of the printed page.

The whole code should be sung through, slowly at first, and then, as each symbol "sticks" in the memory, speed will automatically increase.

By this method, it is possible to learn how each symbol would sound on a buzzer, even though the student had never heard one.

When the student has memorised the code, even at slow speed, he will have passed the most difficult stage. It does not require much work and you can easily make use of time in bus or train.

NORMAL TIME

A quarter of an hour each day for a week should have it embedded in the memory. A number of short sessions are better than one long one.

The ideal method of carrying on from here is to get an operator to send to you at a rate of about 20 words per minute for the letters but with a long break between each letter.

By taking this type of Morse, the beginner will hear each symbol at its correct speed and at its correct rhythm.

Due to the long space between letters, the brain has more time to distinguish between the sounds. As the student improves, the spacing between the letters should be decreased until the timing is correct.

There are lots of radio amateurs who are willing to help a beginner over the first few hurdles. The Wireless Institute of Australia conducts classes to help prospective amateurs, while there are many radio clubs throughout the country affiliated with the Institute. You can also attend one of the commercial radio colleges.

Records either disc or tape can sometimes be bought or borrowed and they are a convenient and practical way of guiding you through to the standard where you can copy some of the slower stations from a receiver.

COMMUNICATION RECEIVER

Of course, if you intend to be an amateur working on the lower frequency bands, you need a good receiver and there is every reason to have it on hand while you are learning the code.

Returning to the main thread of the discussion, the general rules for spacing are as follows: the "dit" being the unit of time on which spacing is based.

1. Dah—3 dits.
2. Space between any two elements of a letter—1 dit.
3. Space between any two letters or figures forming one group—3 dits.
4. Space between groups or words—5 dits.

In the early stages of training, the student should try as far as possible to re-

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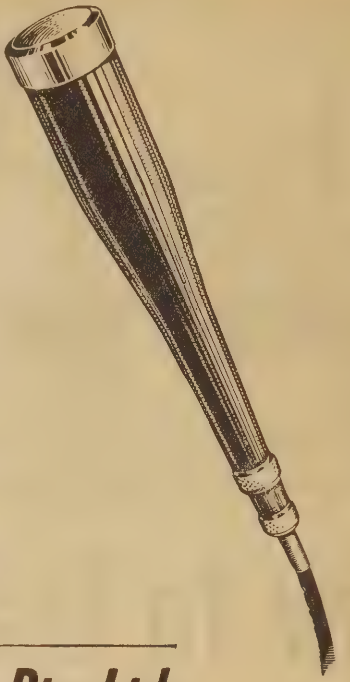

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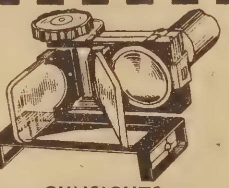

GUNSIGHTS

Contain these lenses:
1 Lens 1in Focus, ½in diam.
1 Lens 1 11/16in Focus, 1¼in dia.
1 Air Spaced Lens, 1¼in diam.
1 Filter Lens, 1 Graticule.
1 Lampholder.

18/6 each

Post: N.S.W., 2/1. Interstate, 3/3.

DIRECTOR DUMPY LEVEL

OTTWAY, WITH TRIPOD, SHOWS ELEVATION and DEPRESSION.

£22/10/- each

Freight payable at nearest attended railway station.

THEODOLITES

Troughton and Simms Theodolites. £37/10/ each.

Freight payable at nearest attended railway station.

FIBRE PULLEYS (AMERICAN).

BALL-BEARING.

1 3/8in diam.,	¼in shaft,	30/ doz.
1¾in diam.,	¼in shaft,	42/ doz.
2 3/8in diam.,	3/8in shaft,	54/ doz.
3½in. diam.,	3/8in shaft.	66/ doz.

Add postage.

RECTIFIER

RA88A new, contains 3 valves 6L6, 3 valves 5T4, 2 valves, 150/30, 1 valve 6SL7GT, trannie, chokes, aluminium chassis. **£4/15/-**

No. 19 TRANSCEIVERS

(Two-way Radio). With power pack, junction bax, leads, etc.

£15/0/0

AIRCRAFT CLOCKS

ELGIN

with sweep second indicator.

£6/10/-

Post: 3/1; Int., 4/3.

VOLTMETER

Pocket Size.
0 to 15 volt D.C. and 0 to 220 volt D.C., with probes. In waterproof Canvas Case.

33/6

Post: 3/4; Int., 4/6.

P8 COMPASS

Liquid filled. As new. Ex-R.A.A.F. Ideal for small boats, etc.

£3/19/6 each

Post: N.S.W., 4/5; Int., 5/10.

PRISMATIC COMPASS

Ex-Army, LUMINOUS. Guaranteed Correct.

£7/15/- each

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Dashboard COMPASS

Small ships. Pioneer American. Liquid Damped with Light. Also suit as car compass.

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GEARED MOTOR

Genuine Oster, variable 12/24v. type B/9/1, 7 amp. Motor r.p.m, 5600, but geared down r.p.m. output is variable, 6 to 20. 57/6 ea.
Post: N.S.W., 5/11; Interstate, 7/3

CHASSIS

RT24/APX2 15 miniature seven-pin ceramic valve sockets and covers trannies, etc.

45/- each

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Ideal for car or TV antennas or blackfish rods. 13ft in 12in sections.

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CRYSTALS NEW

In the following frequencies: Kc's 5397.5, 5852.5, 5205, 5660, 4840, 5295, 4495, 4950, 5327.5, 5782.5, 4397.5, 4852.5, 5780, 6235, 5920, 6375.

25/- ea.

Complete coil and crystal units for Walkie-Talkie SCR536. New £2/10/ per set. Add postage.

WALKIE TALKIE 2-WAY RADIO

with tank coil, crystals and batteries

£7/19/6 ea.

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522 TRANSCEIVER

Complete £12/10/; 522 Transmitter £6/15/; 522 Receiver, £6/15/; 522 Chassis.

45/-

TELEPHONE CABLE

BRAND NEW. NYLEX ROTPROOF COVERED.

£4/17/6 per mile

Freight payable at nearest attended railway station.

DEITCH BROS.

70 OXFORD STREET, SYDNEY. Between Crown and Riley Street, City.

ceive code groups in preference to plain language or p/1, as it is generally known.

The reason for this procedure is that with the reception of the p/1 the beginner involuntarily starts to "journalise" and the system is defeated.

To illustrate the point: If the sentence, "He went away," is being sent, he would receive, "He went aw . . ." and before the "ay" was sent the student would have written it down.

Other traps for the beginner are such words as "formed-forming" and "stayed-staying," where "ed" has been written down before the final part of the word is sent, and often the wrong suffix is added.

Code groups are groups of five letters with the space of five dots between them. By using these for practice, the student does not know which letter is coming next. Later on, these groups may also contain figures, but it is advisable for the student to master the letter groups first.

A list of the 10 primary figures in the Morse code is given in this article. These are not as hard to master as at first may appear.

THE FIGURES

To begin with, the 26 letters of the alphabet are made up of from one to four units. The figures all have five units. To determine from the figure 1 to the figure 5 it is merely necessary to count the dits. The balance of the five units is made up of "dahs" so that the figure 2 has two dits followed by the three "dahs" necessary to make the character up to five.

From 6 to 0 is exactly the opposite. By counting the number of "dahs" appearing, we have either 6, 7, 8, 9 or 0. For example, if "dah dah d' d' dit" is sent, merely say: "Six, seven d' d' dit" (to yourself), and write down seven.

There is no figure 10. The correct method to send 10 is to send the figure 1 and then the figure 0.

After mastering the alphabet and the figures, the student may now spend some ime on p/1. This is done in ordinary andwriting, but care must be taken to ensure clear legible characters in the early stages, so that when speed does come the student will not tend to scrawl.

After some practice it will be possible o keep one letter behind the sender, so hat if the word "coming" is being sent he student will be writing "c" as the 'o" is being sent and at the end of the vord, while the operator is pausing for he next word, the student will be writing he "g."

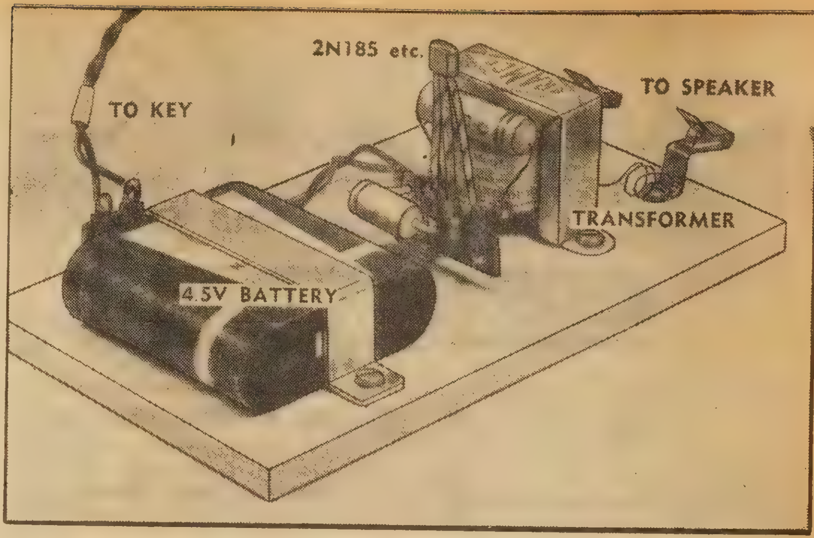
COPYING BEHIND

Experienced operators are able to vrite several letters behind the operator vho is transmitting and even get three r more words behind without being oubled.

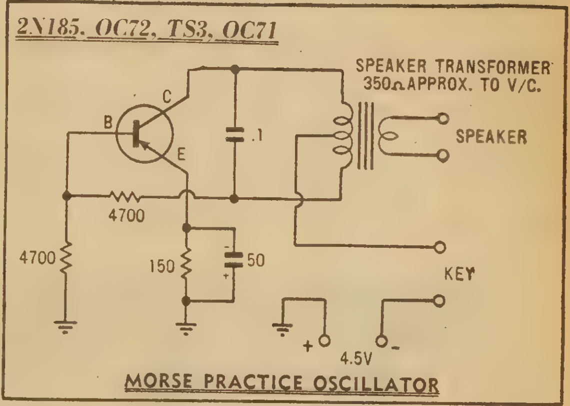
Once the student has mastered the hythm of Morse signals by receiving ractice, he may take to the key but it useless for him to try and send unless e knows how each symbol should ound.

The good Morse operator sits upright his chair with both feet flat on the oor. The left hand is placed comfortbly on the table in readiness for turng a page.

There are many different methods of eying, but the most successful method that which was adopted by the .A.A.F. The method was to hold the key between the ball of the thumb and the forefinger. The second finger was placed on the right of the key towards the bottom.



Above: You can build your oscillator in a finished metal cabinet, or you can make the above in half an hour if you wish. Baseboard dimensions are 7in by 4in.


2N185, OC72, TS3, OC71
SPEAKER TRANSFORMER 350Ω APPROX. TO V/C.
C
B
E
.1
SPEAKER
4700
4700
150
50
KEY
+
-
4.5V
MORSE PRACTICE OSCILLATOR

Right: The circuit diagram is about as simple as an oscillator could be. No battery switch is required since the battery circuit is completed only when the key is pressed.

Then, instead of pressing down with either the fingers or the whole arm, the wrist was held horizontal and dropped whenever a symbol was made, i.e., the upward and downward movement of the wrist was the method of keying. This method is recommended because it reduces "arm fatigue" over long periods of operating.

MORSE FIGURES

SOUND	MEANING
d' dah dah dah dah	1
d' d' dah dah dah	2
d' d' d' dah dah	3
d' d' d' d' dah	4
d' d' d' d' dit	5
dah d' d' d' dit	6
dah dah d' d' dit	7
dah dah dah d' dit	8
dah dah dah dah dit	9
dah dah dah dah dah	0
d' dah d' dah d' dah	dot
d' dit d' dit d' dit	comma
d' dah d' dah dit	end

The tendency is, however, to stray from this method and attempt to "nerve send." The student is advised to pay particular attention that this does not happen and that slovenly habits do not creep on him and ruin his operating.

Many people will argue that the "wrist-movement" method is cumbersome and that it is impossible to reach any high speeds but countless operators have disproved this theory by passing the 30 w.p.m. rate by "wrist" action alone.

Of course, as speed increases, the wrist action becomes less noticeable but the beginner should allow his wrist to drop the full distance while sending at low speeds.

By "following through," even though contact is made by the first movement of the wrist, greater key control is obtained.

CHOOSING A KEY

There is no real need for an elaborate or excessively expensive key but on the other hand you should avoid a very cheap key with mild steel contacts which may not always have the required low resistance. Good keys can be purchased through the trade channels and are still available from the stores selling military disposals goods. Some of the military keys were a bit on the small and light side unless fixed to a baseboard but this is easily remedied.

Electrical contact is made by the front stop of the key and its anvil. The distance between these two points is called the "gap" and should be equal to the thickness of a sheet or ordinary foolscap folded once.

The spring tension is supplied by the

(Continued on Page 63)

NEW *Releases!*

CLASSIC RADIO TAKE PRIDE IN ANNOUNCING COMPLETE NEW RANGE OF MONAURAL AND STEREOPHONIC EQUIPMENT

Stereophon LIVING SOUND

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16 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo, comprising a compact Hi-Fi Stereogram in two units featuring a high gain dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls in one unit and two Mullard 5-10 amplifiers with push-pull outputs and power supply on second chassis. **£69/15/-** F.O.R.

Two pair of M.S.P. Jensen speakers or two Rola 12in dual coned speakers supplied. Power output 10 watts per channel (20 watts). Frequency response of amplifier 40 to 15,000 cycles.

---

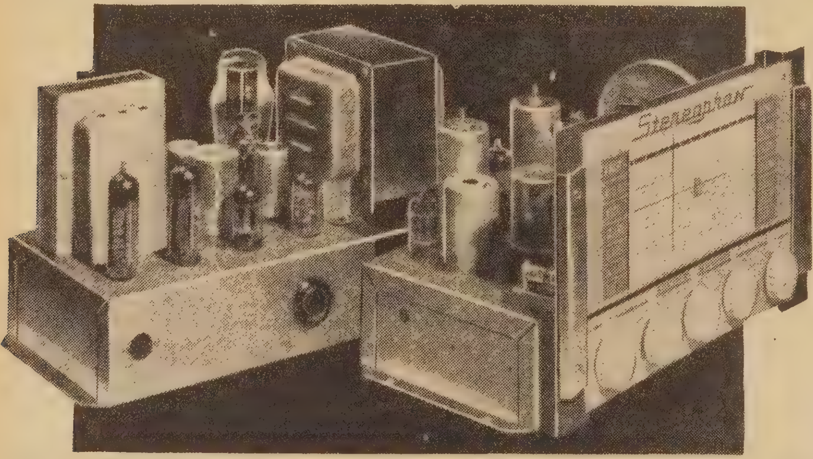
10 VALVE HI-FI STEREOGRAM CHASSIS

Complete stereo unit comprising dual wave tuner with tuned R.F. stage, multi-input two channel pre-amplifier with tone controls and two Mullard 3-3 amplifiers, power supply on separate chassis. Supplied with two Rola 8MX speakers. Power output 4 watts per channel. Frequency response of amplifier 40 to 15,000 cycles. **£48/15/-** F.O.R.

---

8 VALVE HI-FI STEREOGRAM CHASSIS

Complete tuner and amplifier for stereo incorporating the "Mullard 3-3" amplifier circuit with separate bass and treble controls. Output 3 watts per channel. Supplied with two Rola 8MX speakers. Frequency response 50 to 10,000 cycles. **£38/15/-** F.O.R.



ALL UNITS INCORPORATE THE NOW FAMOUS "MULLARD" AMPLIFIER & TONE CONTROL CIRCUITS.

SPECIFICATIONS ON OPPOSITE PAGE

→

A NINE VALVE HIGH-FIDELITY RADIOGRAM CHASSIS

Nine and ten valve chassis incorporate the Mullard 5-10 AMPLIFIER CIRCUIT. Frequency response 40-13,000 cycles. Max. output 10 watts.

£42/15/0 F.O.R.

A NEW 10 VALVE DUAL WAVE RADIOGRAM CHASSIS

WITH BASS AND TREBLE BOOST.

The ideal chassis for those difficult locations where reception is doubtful. Specifications as nine valve unit, but with the addition of high gain tuned R.F. stage giving greater sensitivity and selectivity on both broadcast and short-wave bands.

£45/15/0 F.O.R.

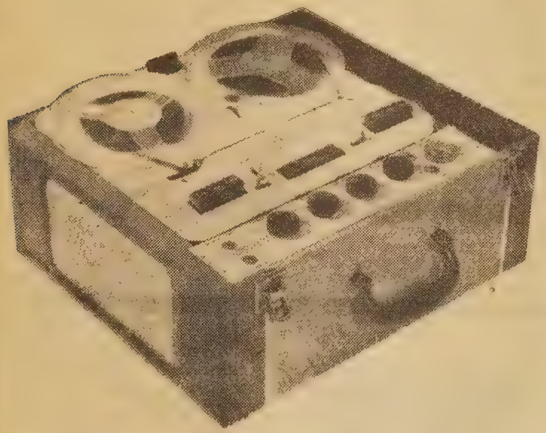
ALL CHASSIS GUARANTEED FOR A PERIOD OF SIX MONTHS. ALL 4 SPEED STEREO RECORD CHANGERS AND PLAYERS STOCKED.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

Buying a Tape Recorder?

First see and hear the new Hi-Fi Recorder by Classic incorporating the new Collaro Mark IV Transcription deck. The only deck with ALL these features.



THE COMPLETE UNIT IS SUPPLIED IN ATTRACTIVE AND DURABLE TWO-TONE COVERED CASE COMPLETE WITH ACOS MICROPHONE AND FITTED WITH DUAL ROLA SPEAKERS.

The seven-valve amplifier, including level indicator, incorporates the latest "Mullard" tape recorder circuit equalised to C.C.R standards giving perfect reproduction from recorded tapes. Record monitoring and outlet to power amplifier. Extension speaker outlet and "magic eye" level indicator Amplifier is completely shielded and fitted with perspex dress plate to match deck.

- **HIGH FIDELITY**
  Heads are double coil wound and will reproduce up to 12,000 c.p.s. at 7½ inches per second. Azimuth adjustments on both impedance "record" and "playback" heads. Output of heads is approximately 5 milli-volts at 1 Kc at 7½ inches per second.
- **INSTANTLY REVERSIBLE**
  Instantaneous changes can be made from one track to the other. Fast rewind in either direction
- **CONSTANT TAPE TENSION**
  A special Collaro device ensures a constant tension on the tape on the take-up spool as it leaves the capstan.
- **FULLY MECHANICAL**
  No solenoids are used in the construction of this Transcriptor. The braking is entirely mechanical
- **FINISH**
  Cream Polystrene cover plate with maroon controls.
- **THREE SPEEDS**
  3¾, 7½ and 15 inches per second
- **FOUR HEADS**
  Two "Record/Play-back" and two "Erase" heads are sited on two different levels and head wear thus halves for any given length of track
- **TWIN TRACK OPERATION**
  One pair of heads for each track. Both top and bottom tracks can be recorded or played back without removing tape.
- **PAUSE CONTROL**
  This has the effect of stopping the transit of the tape past the "Record/Play-back" and "Erase" heads and applying the brakes to the spools while leaving all switches and mechanical functions in their selected positions. Typical application is to pause whilst recording to omit speech interposed between musical selections. Control will only work whilst it is held in position.
- **TAPE MEASURING & CALIBRATING DEVICE**
  The three digit counter makes the location of any recorded passage the simplest of operations
- **TRANSCRIPTION TECHNIQUE**
  A large diameter flywheel with ground and lapped steelshaft running on a ball at the bottom of long bearing reduces friction and virtually eliminates "wow" and flutter at less than 0.15 to 1.0 per cent.
- **TWO MOTORS**
  Each dynamically balanced motor does only one job at a time. Motors never act against each other and are of low wattage input with consequent reduction in heat and wear.

COMPLETE RECORDER WITH MIKE — 84 GNS. f.o.r.

DECK WITH AMPLIFIER, POWER SUPPLY and 6in x 9in SPEAKER, 71 GNS.

AMPLIFIER AND POWER SUPPLY FOR COLLARO DECKS WITH VALVES (7) £34/10/- f.o.r.

SPECIFICATIONS OF OUR NEW HI-FI CHASSIS

NEW:

ltramodern circuit using nine high gain valves including "magic eye"
ning indicator. Permatuned iron cored coils and intermediates giving ex-
ellent interstate reception and a short-wave range of 12,000 miles. All
alves used are the new Mullard nine-pin Innoval series.

NEW:

one control and audio stages incorporating the Mullard 5/10 amplifier
rcuit with separate bass and treble controls giving plus or minus 15 db
oost or cut at 50 cycles L.F. and 10,000 H.F., combined with push-pull
utput with inverse feed-back gives you really high fidelity reproduction
om your radio or favourite recordings.

NEW:

ual speaker combinations using the new Jensen M.S.P. 12PR woofer
ith matched tweeter and cross-over network giving a frequency
sponse of 40 to 12,000 cycles. If required the Rola 12MX speakers can be
pplied (with the 8 valve stereo chassis, two Rola 8MX speakers are
pplied). A.W.A. output transformers used on all units.

NEW:

Six position selector switch is incorporated in all chassis with compensation for L.P. recordings and provision for stereo F.M., or TV tuners and tape recorder

NEW:

Large calibrated edge-lit dial in perspex (11in x 6in) with main stations of each State in prominent type. Dial fitted with counterweight drive, giving smooth tuning. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW:

Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate overseas and country stations.

All chassis are wired for the fitting of F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for gramo. motor.

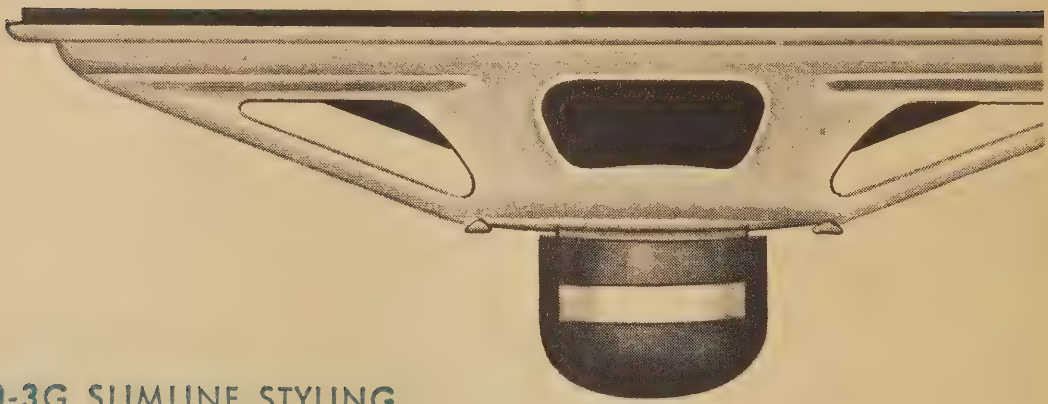
Power switch is fitted to volume control. Audio end of set can be used with TV receiver if required.

Classic Radio

245 PARRAMATTA ROAD, HABERFIELD, N.S.W. PHONE UA2145.

Superseded!

TV "Side sound" now out of date



10-3G SLIMLINE STYLING

The Rola Model 10-3G loudspeaker ushers in a new era in TV sound. Prior to the development of this rather queer-shaped, but technically efficient, loudspeaker the sound from most table, portable and small console TV receivers came to the viewer from all kinds of odd angles. The aim of the designers of these types of TV receiver cabinets was to economise in space. To meet this requirement they mounted the conventional round or elliptical speakers so that the sound was bounced off the ceiling or radiated at right angles to the viewer. Never was the sound coming from the same source as the picture. Never was there the "marriage" between sound and sight so necessary to full realism.

Appreciating the problem Rola engineers set out to develop a loudspeaker which would really work under the exacting conditions imposed by space-saving TV set design.

The result justified their efforts for they came up with a loudspeaker which could be mounted vertically to reduce the width of the TV receiver cabinet, required no compromise in cabinet height and put the full audible range of the sound it reproduced just where the viewer wanted it — *right in the picture.*

The now available Rola 10-3G, the TV speaker of tomorrow, is here today!

Specifications

Power handling capacity	3½ watts peak
Diaphragm fundamental resonance	110 c.p.s.
Frequency response	105 c.p.s. — 6 K.C.
Voice coil impedance	3.5 ohms at 400 c.p.s.
Air gap flux density	8,800 Gausses
Total gap flux	18,200 lines
Transformer	Q or D
Principal dimensions:	
Overall diameter of diaphragm housing	10" x 2⅝"
Size of baffle opening	$9\frac{7}{16}$" x $2\frac{9}{32}$"
Diameter of voice coil	⅝"
Depth from pad ring to rear	2¾"

ROLA

ROLA COMPANY (AUST.) PTY. LTD.

THE BOULEVARD, RICHMOND, VIC., JB 3921.   CALTEX HOUSE, KENT ST., SYDNEY, N.S.W., BU6147 spring at the back of the key, and should be just tight enough to cause the key to return to the open position after it is pressed. If it is too tight it may cause operating fatigue.

When operating, try to keep the fingers arched and the muscles loose.

Some common faults with beginners are:

1. Slurred characters.
2. Clipped dashes.
3. Bad spacing.
4. Running words together.
5. Sending too fast.

From this stage on, all that is needed is practice and more practice. A little each day is worth more than a lot once a week.

Handbooks on Morse will carry the student further on the subject but if he is prepared to work, the data given in this article will put him in the speed category in a matter of a few weeks. (We can recommend "Learning the Radio-telegraphic Code" published by the A.R.R.L.).

Taken on the average, the hardest letters for the beginner to remember are: D B F G W L Q Y K R P X.

A practice chart could easily be compiled to place emphasis on these letters. Send the groups from left to right and then, for variation, read downwards in columns.

Remembering that practice makes perfect, make up several charts stressing the letters that you find most difficult. Keep at it until you have mastered them.

We would stress again the importance of listening to the code at every opportunity. Get yourself a short-wave receiver, and look around the bands for commercial stations sending at reasonable speed. You can sometimes strike such stations sending code groups at less than 20 words per minute, repeating each group after it has been sent. This is especially good practice because you have an opportunity to check your first attempt.

As you progress, you can pick out a station sending at a higher speed. Do not develop the complex of despair if you find yourself receiving only portion of what you hear. Take this philosophically, trying to develop an attitude of mind which refuses to be "rattled."

BUILDING PRACTICE OSCILLATOR

The earlier part of the article tells you how to learn the Morse code. Here is a simple practice oscillator which will make the job much easier. Parts required are few and readily available while the current drain is so low that the battery will last virtually its shelf life.

TRADITIONAL aids to learning the Morse code are a key, buzzer and battery—plus a patient operator willing to send correct characters while you gain experience.

While some of the disposals buzzers are quite reasonable, most of the ordinary ones you buy in shops are not very satisfactory. Not only do they have an unpleasant note but they are very difficult to adjust and seem to get out of adjustment very often.

Battery operated valve oscillators work very well but require both low tension and high tension batteries. The former, particularly, have a fairly short life. Mains operated oscillators need a power transformer, rectifier valve, etc., and therefore tend to be a bit expensive and bulky.

The advent of transistors, however, has made it possible to build a simple battery operated oscillator which costs very little and in which the original battery will probably see you reach the desired standard of proficiency.

A special transformer would normally be required for a transistor oscillator. This would ruin the project from the homebuilder's point of view so we set out to see what could be done with a standard transformer.

Subsequently, it was proved that any one of the standard output transformers used in the "Transporta" series could be made to work without alteration to the circuit. These are made by a number of manufacturers and are normally intended to reflect between 300 and 400 ohms from voice coil, depending on the particular transformer.

The transformer primary and a paper capacitor form a tuned circuit which largely determines the frequency of oscillation. The value we have shown in the circuit is 0.1 uF which gives a note of 1,000 cps or thereabouts.

If you would like a higher note you can use a smaller value of capacitor or if you would like a lower note choose a larger capacitor. At the expense of a switch and an extra capacitor or two you could have the note variable. This may be a good idea because the one note does tend to become tiring after a long period.

CIRCUIT DETAILS

The negative supply line is fed to the centre tap of the transformer primary and thence to the collector of the transistor. Feedback, in the correct phase to promote oscillation, is taken from the opposite end of the transformer to the base of the transistor. Both the feedback and the negative supply voltage are subject to the action of a divider network before being applied to base.

The initial DC component biases the transistor into a high gain region so that oscillations can commence. However, audio power is wasted, particularly in the 4.7K resistor from the transformer to base. There is plenty to spare, however, and the transistor will oscillate and produce a useful output in the speaker with lower voltages than specified.

The 150 ohm resistor in the emitter circuit is part of the bias network. Degeneration across this resistor is prevented by an electrolytic capacitor.

Audio energy is fed to the speaker via the normal voice coil winding on the transformer and with a speaker of normal sensitivity between 3in and 6in diameter will give comfortable volume. If you would like to elaborate the oscillator by providing a variable volume control, this could consist of a 10 ohm potentiometer connected across the voice coil winding. The speaker would be connected between the moving arm and one side of the pot.

NO SWITCH

No high tension switch is required because the key itself behaves as a switch. Oscillations commence cleanly as soon as the key is pressed. This has the big advantage that power is being drawn from the battery only when the oscillator is actually delivering audio.

Current drain is only 10mA so that the total power from the battery is much less than that required for the filament of an ordinary battery valve.

The mechanical form of the oscillator is not at all important. We built it in the piece of plywood shown in the photograph but there is no reason why it could not be made up in more permanent form with a metal case if desired

MORSE CODE PRACTICE GROUPS

The following are difficult groups. Correct spacing is essential otherwise the result of your sending will be meaningless.

APR6V	CD5HM	GU3FB	HNU3Z	LPPFQ
LYQG7	V9LP4	SR1OK	BRG6L	YKTNM
DX2VO	L1RPV	4BGUZ	YE2GJ	TOMMO
OPLM1	NU3RX	B9HMY	TUD1Z	5HH54
QP3BY	P8GYD	9COGF	AC8FA	6B5HL
IU0TZ	SK3RM	PKU7N	DOYBG	WATEM
I7YJP	N3UGL	IN8FS	G4QFS	GOOGD
K4KVB	AXN30	Z5GTO	Z7GUT	JAMIE
UF9LQ	SOF4U	6LUYP	6B6BD	FLYPQ
Y6YUT	T0QMO	PDQRV	FINDT	JWTAM
R5KYQ	R4BWD	2LUXN	QYQYQ	B6LAI
F6CQS	XP7UV	P8BRG	ZM1ZG	TUTUV
PBUA4	LP2LD	LMO9Y	SHIEH	XPANY
MY6QS	A8FYK	PUXX8	LREB6	GTNME

A typical picture off the screen of the 110-degree receiver. For the photographic enthusiasts, the film was HP3, the exposure 1/25th. and the aperture 3.5.

How To Build The 1959 TV Set

PART THREE—FINAL ADJUSTMENTS

Those who have completed the constructional work covered in the last two issues will have their new 110-degree receiver all ready to switch on. This present article explains in detail how to effect the various adjustments necessary to obtain an optimum picture.

by Neville Williams

BEFORE discussing further the actual receiver, it may be wise to interpose few remarks about the provision of a aerial to allow valid air-tests to be ade.

The fact that the receiver may have erated previously on sound only with tle or no aerial is not significant, since e signal requirements for a good picre are much more exacting than for ceptable sound.

AVE AERIAL READY

Undoubtedly, the ideal course is to ve an aerial ready for the receiver, stead of trying to rely on the signal ckup from odd pieces of wire. With the tter, it is not at all unusual for a reiver to exhibit "ghost" effects, wide gnal fluctuation with any nearby movent, erratic synchronisation and high cture "noise."

Constructors should have no difficulty making up a perfectly efficient outor aerial system and typical designs re detailed in the November, 1958, ue. Alternatively, commercial aerials e readily available and can be erected thout too much trouble.

While there are undoubtedly "optim" electrical positions for an aerial around the average home, not all of them are practical and other important considerations intervene, notably convenience and appearance.

Except in known "difficult" areas, it is normally satisfactory to erect the aerial in a position which is practical, which faces towards the stations with the least amount of intervening structure and which does not involve any greater length of lead-in than is strictly necessary.

This lead-in ribbon, by the way, is normally twisted about once per foot along its length.

In selecting the type of aerial, be guided by the nature of your district. If the signals are at good strength and not unduly subject to ghost interference — your neighbours will already have found this out—settle for a fairly simple aerial system.

If the signal level is low or complicated by reflection paths, you will have to think in terms of something more elaborate.

Where space permits, it is possible to mount television aerials beneath a nonmetallic roof. This has obvious good points but it is also true that the polar diagram of such an aerial is seldom as good as when it is mounted clear of electrical wiring, guttering, hot-water systems, etc. The practice, therefore, becomes dubious in poor to difficult situations.

INDOOR TYPES

"Rabbit-ear" and similar aerials, sitting atop the receiver are practicable in medium to good signal areas but have the disadvantage that the picture quality is likely to suffer unless they are suitably orientated, sometimes for individual stations. They are readily knocked out of place and subject to variation with the position of metal windows, blinds, furniture, etc.

If you have to rely on a temporary aerial, a good plan is to make up a resonant folded dipole from ordinary 300-ohm ribbon, which can be pinned to the picture rail or other woodwork in the room. Dimensions for such an aerial are given in the sketch elsewhere in the article.

Its position in the room for the best signal is likely to be such that it forms a shallow "V," with the interior centre line pointing at the stations.

If it can be attached to the rafters under a non-metal roof, so much the better. In good signal areas such an aerial may be perfectory satisfactory for permanent use.

Now to get back to the receiver.

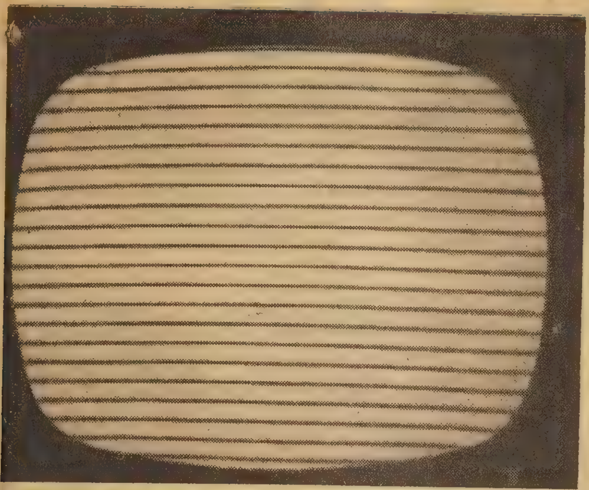
Having completed the constructional work, there remains the task of getting it into operation and making the necessary adjustments for optimum performance. This may be a simple matter or otherwise, depending on facilities, earlier checking — and a certain amount of chance.

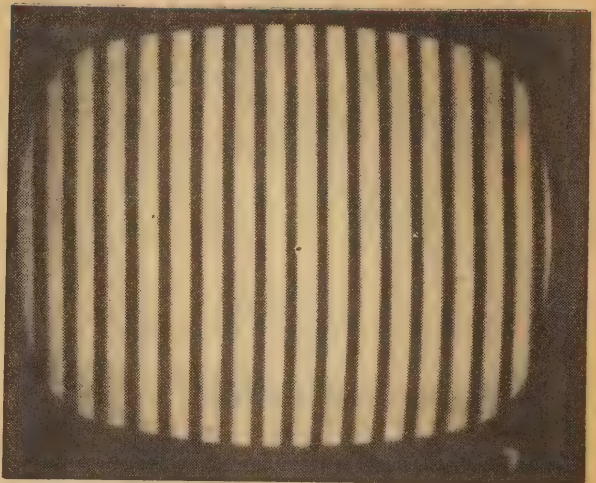
TESTED IN SECTIONS

Our advice, earlier, was that the receiver should be tested in sections, during its construction, leaving as little to worry about as possible when the final stages were added. At the very least, the tuner, IF and sound system should have been operating and a check made on the presence of plate and screen voltages on most of the other stages.

This should obviate any great worry about shorts on the high tension line.

VERTICAL, HORIZONTAL LINEARITY PATTERNS





Even so, it is wise to clip a voltmeter across the high tension line, prior to each new test and the final test, just to make sure that volts appear immediately the switch is closed. If they don't, switch off immediately and start looking for trouble.

It is a good idea to check the receiver with everything operating before the tube and harness is actually bolted in position. Plug the yoke into its socket and rest it the best way you can, making sure that the windings do not touch any netal work. Let the EHT lead dangle n the clear or lay it on the bench clear of metalwork and tools.

It takes a little longer for the deflection circuitry to come into operation han for the sound system but, after another 15 seconds odd, pick up the EHT ead well back from the exposed clip ind bring it towards the chassis. A park should jump the last 3/8in or so, ather like an ignition discharge.

If the EHT is present, it is prima acie evidence that the line output circuitry is operating.

Having verified this much, switch off again and instal the picture tube and harness, not forgetting to earth the outer coating on the rear of the glass flare.

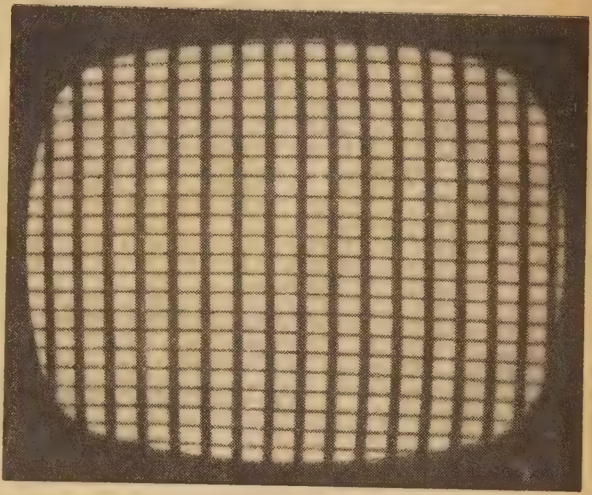
ARTHED BRAID

We did this, in the original set, by retching a length of outer braid from hielded wire, from the top of the tube amp towards a solder lug near the ont edge of the chassis. Tension was rovided by a small spring (from a dial echanism) stretched between the braid id the lug.

The yoke should be pushed on to the ck, hard against the flare, and with e outgoing leads downwards. Tighten e clamp sufficiently to hold the yoke asonably firm, though you may need er to rotate it slightly to obtain true rtical and horizontal lines.

Set the three potentiometers at the ar of the chassis in about their mid sitions, likewise the Horizontal and rtical Hold potentiometers. Set the ntrast control potentiometer to maxiim resistance, representing minimum ntrast.

To those who have access to a Bar Pattern Generator, patterns such as these can be obtained. Those shown here were photographed off the screen of the prototype receiver using a Taylor Generator type 94B. The camera lens was lined up accurately with the centre of the screen, some of the slight aberration around the edge is still attributable to the curvature of the glass. The tube was not masked for the photographs.



The cores of the Horizontal oscillator coil, the Sine Wave coil, the Horizontal Linearity and Width coils may just as well remain as received from the manufacturers though, if they have been altered, they could be set about halfway into their respective coils. They will naturally have to be adjusted accurately later.

With the various adjustments so set and the yoke and EHT leads in position, switch on again. You will probably hear a slight rustling from the rubber surrounding the tube face, as the EHT builds up, and simultaneously some illumination should appear on the screen. If not, try advancing the Brightness control.

In some cases, it may be necessary only to rotate the Horizontal and Vertical hold controls to obtain an immediate picture. In others, a little more fiddling may be necessary to secure a stationary image.

PICTURE ROLLS

Failure to lock vertically causes the picture—or whatever is on the screen —to roll downwards or to flick upwards.

Failure to lock horizontally produces a series of streaks running obliquely across the screen.

If neither oscillator is locked, the pattern on the screen looks extremely confusing at first glance, since it is a series of unstable oblique streaks, which are also flicking or rolling vertically. Despite the complex appearance, however, it does not take one long to recognise this condition for what it is.

Rotate the Vertical Hold potentiometer until the vertical movement stops, leaving just the pattern of streaks. These may respond to the Horizontal Hold control but, if they don't, try different setting for the Fine Tune control, and/or switch to another active channel.

WRONGLY TUNED

The point behind this is that a receiver may not lock if it happens to be tuned away from the video and towards the sound carrier. It is therefore necessary to allow for this by varying the tuning or the channel until picture lock is achieved. Once the set is properly adjusted the same difficulty will not recur and the receiver will—or should —lock automatically as it is switched from channel to channel.

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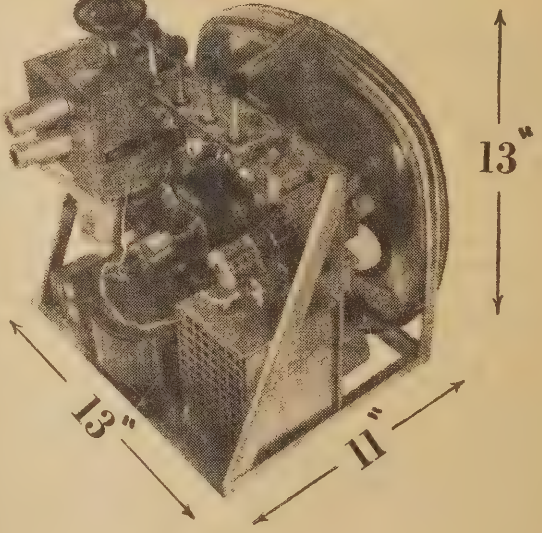

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If it will not lock horizontally, adjustment will be needed to the Horizontal oscillator coil and possibly to the Sine Wave coil. Set the Horizontal Hold potentiometer at the centre of its travel and rotate the core in the Horizontal Oscillator coil until the picture locks.

In terms of general behaviour, you will find that screwing the core in progressively lowers the blocking frequency and ultimately reduces the pattern on the screen to a series of broken lines. At the same time, you may also be able to hear a whistle from the line output transformer of gradually reducing frequency.

Screwing the core out ultimately produces what looks like a "motor-boating" effect, the pattern on the screen pulsing violently and being accompanied by squeaking noises from the core of the Horizontal output transformer.

In between these two extremes, the picture should lock, even if in a rather erratic fashion.

This latter condition would be explained by an unsuitable setting of the Sine Wave coil. This should ideally be adjusted with the aid of a CRO, using a low capacitance lead or a short length of unshielded wire clipped to the junction of the Sine Wave coil and the tapping on the Horizontal Oscillator coil.

CORRECT WAVEFORM

Keeping the picture locked with the core in the oscillator coil, adjust the core in the Sine Wave coil until the waveform is obtained, as shown in the circuit. An actual photograph of this same waveform from the prototype receiver is reproduced herewith.

If no CRO is available, a more involved procedure is necessary, as follows:

Set the Horizontal Hold potentionmeter at the centre of its travel and temporarily short out the Sine Wave coil with a scrap of wire.

Adjust the core of the Horizontal Oscillator coil until the picture locks.

Put a small spot of paint or a pencil mark on one side of the nut—or use a tool on it—so that you can judge each complete revolution. Aided by this, note the number of turns through which the core can be rotated before the picture breaks up.

Set the core in the middle of this "locking range."

Leaving the Horizontal Oscillator core so set and without touching the Horizontal Hold potentiometer, remove the short from the Sine-Wave coil. The picture may now tear again but adjust the core in the Sine-Wave coil until synchronisation is regained. (To adjust this core, you will need a non-metallic alignment tool or a knitting needle sharpened to a fine, narrow screwdriver point.)

You will find that the Sine-Wave coil also has a certain locking range, the picture breaking up if the core is screwed too far in or out. Set the core about two-thirds of a turn back from the "too far in" limit, at which setting the waveform across the coil should be fairly close to optimum.

LOSS OF SYNCH.

If you find subsequently that the receiver tends to lose synch. when switched from Channel to Channel, irrespective of the Hold adjustments, the core in the Sine-Wave coil can be screwed out a trifle more. This should not normally be necessary, however, and the core should not need further attention.

As a final check on the "Hold" adjustments, observe what happens when the Horizontal Hold potentiometer is now rotated from the centre position, which it should have occupied for all the foregoing adjustments, whether using a CRO or not.

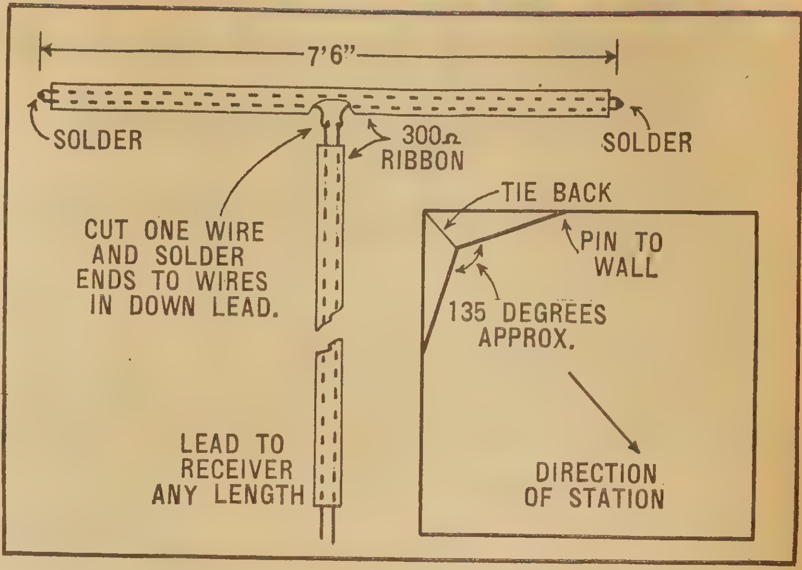
BALANCE CONTROL

You may find that the picture will tear when the pot. is turned one way but not the other. In this case, screw the core of the Horizontal Oscillator coil in or out by a small amount to "centre" the action of the potentiometer. In the original receiver, it was possible to find a position where the picture would lock over the main travel of the pot. but tearing at either end.

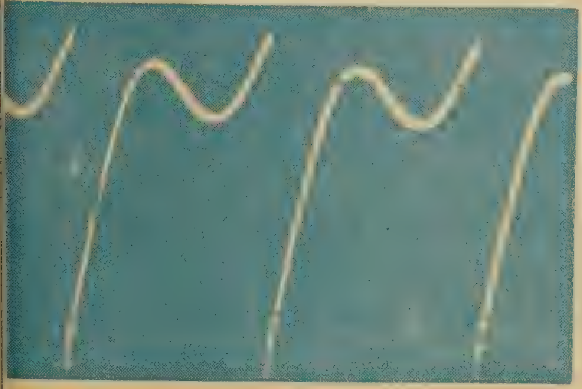
This is the logical condition to adjust for, since it makes full use of the available range in the panel control.

The same remark applies for the Vertical Hold potentiometer. The picture should, in any case, lock vertically at some point in the potentiometer's travel but you may find that the locking range

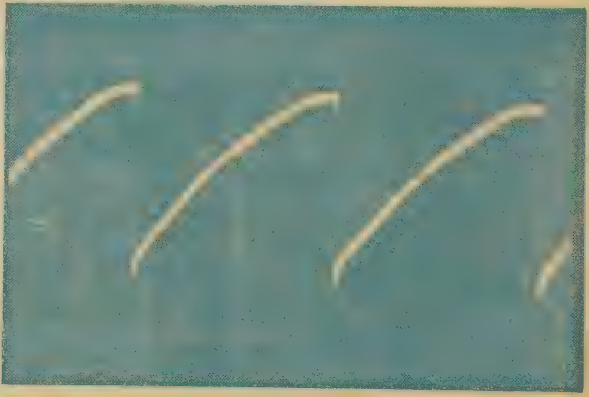
TV AERIAL FROM 300-OHM LEAD



Don't try to test your television receiver on the signal picked up by a stray piece of wire. If a proper aerial installation is not ready, at least make up a dipole from 300-ohm ribbon as shown above.



Here is a specimen waveform at the junction of the sine wave coil and the tapping on the oscillator coil.



Included purely as a matter of interest, this is the waveform at the grid of the horizontal output valve.

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This comprehensive valve tester and combination multimeter is designed to operate from A.C. mains. It combines the functions of a multimeter, output meter and valve tester.

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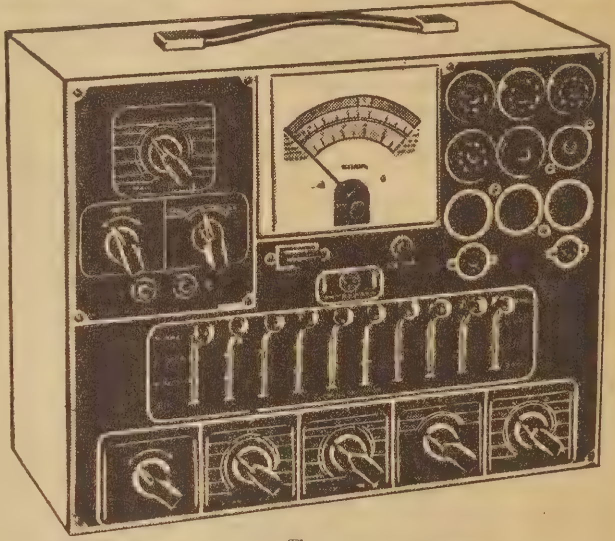
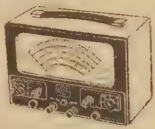
Instruction booklet and test leads are supplied and the carrying handle lies flat on the case when not in use. Television picture tubes can be tested by using adapter type TV2. Outside measurements of the instrument are 14in x 11in x 6in.





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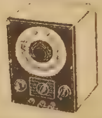

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is initially concentrated to one end of the element.

If the picture remains locked vertically with the control at the minimum resistance setting, try reducing in value the 1-megohm resistor in series with the potentiometer. A value of 0.82 meg. is suggested.

Conversely, if the locking range is concentrated at maximum resistance setting, increase the series resistor from 1.0 meg. to 1.2 meg.

Once again, it is logical to balance the circuit so that the picture remains locked over the major portion of the potentiometer's travel, losing synch when it is turned to either extreme.

HORIZONTAL OSCILLATOR COIL

The horizontal oscillator coil is branded in the receiver as type THB2. This is an error. It should read THB1, being the same component as used in earlier receivers.

Next logical step is to adjust the scanning circuits for linearity and this will involve a certain amount of mutual adjustment for both vertical and horizontal circuits, in order to achieve the best end result. It will also involve some manipulation of the centring magnets.

The centring magnets in this case are two small magnetised rings or washers attached to the rear of the yoke assembly and operated by two levers, one for each ring.

When the two levers are 180-degrees apart, the magnetic effects cancel and rotating the two as a group makes little or no difference to the direction of the scanning beam. On the other hand, with the two levers together, the magnetic effects add and rotating the two as a group moves the beam — and therefore the picture as a whole — in any desired direction, up, down, sideways or obliquely.

DIFFERENT EFFECTS

In between these two extremes, with the two levers neither together nor 180-degrees apart, different residual magnetic effects can be obtained, which deflect the beam to a lesser extent.

Appreciating these facts, it should not be difficult for individual constructors to learn quickly how to manipulate the centring magnets to obtain the desired corrective effects and thus keep the image centred on the screen.

One point is worthy of mention. With the levers together, giving maximum beam deflection, you may notice one or more corners of the picture black out as the magnets are rotated. This is the so-called "neck-shadow" effect caused by the beam striking the glass envelope.

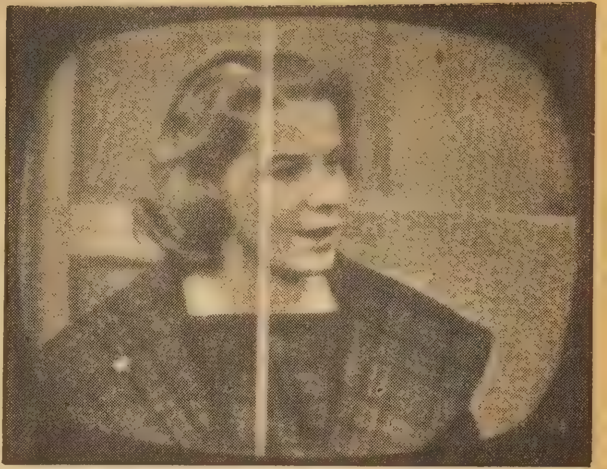
It should not be necessary to use this order of correction with the RTandH receiver. If it is, some malfunctioning of the scanning circuits could be indicated or gross non-linearity which yet remains to be corrected.

Make sure, by the way, that the yoke assembly is pushed hard against the glass flare and suitably clamped.

Now comes the matter of linearity adjustment, and we suggest that the vertical circuits be adjusted first.

The job can only be done accurately with aid of test patterns and, with program times filling up, this will normally mean doing the job in the early morning or at other odd times when a circle test pattern is being transmitted.

OVER-DRIVE CAUSES WHITE LINE



A straight whitish line like this would normally indicate excessive drive to the horizontal output valve though, in special cases, it can be produced by a weak valve or a circuit fault.

The EHT voltage is affected by the brightness of the picture and this, in turn, has some reaction on the scanning characteristics.

It is therefore important to darken the room during daylight hours, so that the linearity adjustments can be made with the average picture brightness about the same as for ordinary viewing.

Another point is that the adjustments are best done with the chassis resting the right way up on a table or bench. Laying the chassis on its side not only makes it more difficult to assess critically the picture shape but the picture will be displaced on the screen by the earth's magnetic field.

PICTURE HEIGHT

Adjust the height of the picture with the "Height" control at the rear of the chassis and rotate the centering magnets on the rear of the yoke until the picture just runs over the top and bottom of the screen. Don't worry at this stage about the sides.

Now view the test circle critically, either by going right around the front of the receiver or viewing it through a large mirror lined up in front of the tube face.

If the bottom of the picture is compressed, turn the Vertical Linearity in a direction which will increase its resistance. Re-set the Height and centring magnets and note the order of improvement. You may have overshot the mark, or you may need to increase the resistance setting still further.

Conversely, if the bottom of the picture is stretched, the resistance setting of the Linearity potentiometer will need to be reduced until the top and bottom of the test pattern are of the same general shape.

Remember that, at this stage, it may not be anything like a perfect circle, since the horizontal linearity and width adjustments have yet to be checked.

As noted in the last issue, you may find that the bottom of the pattern is still tending to stretch slightly, even with the Linearity adjustment at minimum resistance setting. This is particularly likely to happen with a 6EM5 in the vertical output stage or with a particularly active 6CZ5.

In this even, do not reduce the resistance value in series with the Linearity potentiometer. Our suggestion is to modify the basic waveform by reducing the grid coupling capacitor to the vertical amplifier from 0.1mfd. to some smaller value as, for example, an .022mfd.

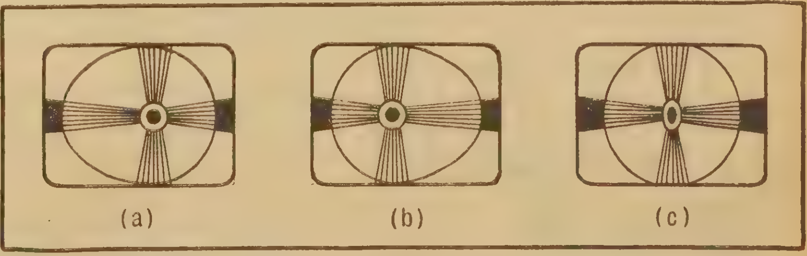
Having adjusted the vertical linearity, at least initially, the next step is to adjust horizontal linearity. This is slightly more complicated but the task will be simplified if certain basic relationships are kept in mind.

COMPOSITE EFFECT

It is necessary to remember that the horizontal scan is the composite of reaction current through the damper diode and plate current of the horizontal output pentode.

The linearity is affected by (1) the horizontal drive (2) adjustment of the linearity coil and (3) adjustment of the width coil.

Excessive drive to the horizontal output pentode produces a sharply defined whitish line down the screen, just to the left of centre. Its edges are usually



(a) (b) (c)

These diagrams indicate three likely effects from poor horizontal linearity. How to correct them is explained in the text.

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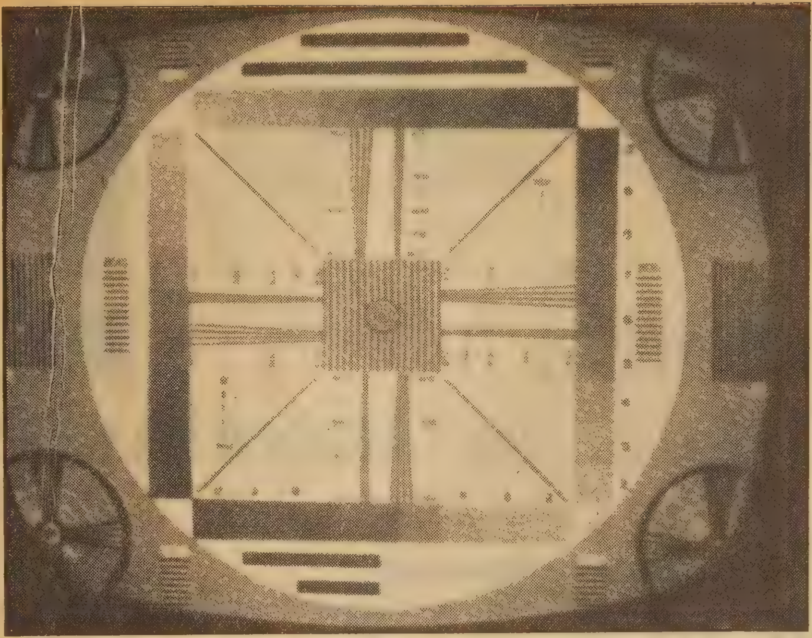

Though not, in itself a masterpiece of off-the-screen photography, this picture does indicate the proportions on an unmasked screen of one of the better known test patterns. Careful measurements will reveal that the height should have been increased slightly, though the overall linearity is far better than is commonly observed in routine commercial receivers. Lack of time prevented us from taking a new photograph.

straight and its position relatively unaffected by adjustment of the Horizontal Hold control. In both respects it differs from so-called "spook" lines, which are normally vague and wavery and affected by the Horizontal Hold setting and, often, by the Fine Tune control as well.

If an overdive line is present on the screen, the screw in the horizontal drive capacitor should be tightened (increasing capacitance) until the line just disappears.

In some receivers, it is sufficient to leave the drive capacitor at this setting but, in others, further adjustment of the capacitor may be warranted to obtain optimum linearity.

DRIVE ADJUSTMENT

In our present receiver, we did not encounter the white overdrive line, but we did find that the drive could be adjusted to advantage, in order to obtain optimum linearity. Further, that it was possible to screw the capacitor over most of its range without making any great difference to the EHT voltage.

If you have access to a suitable meter, you can repeat our observations. If not, be guided by the principle that some reduction in drive can be made in the interests of linearity. However, the reduction should not be more than is strictly necessary to achieve the desired result and should preferably not involve screwing the capacitor up tight to its absolute maximum value.

The accompanying diagrams illustrate the basic rules on which the horizontal linearity adjustment can proceed.

If the left-hand side of the pattern is expanded and the right-hand compressed as in (a) correction may be obtained by decreasing drive to the horizontal output valve and/or bringing the slug into the width coil to increase its inductance.

(It is important to note that, in the width and linearity coils, the slug moves into the coil to increase inductance as the brass screw is rotated anti-clockwise.)

If, conversely, the left-hand side of the pattern is compressed and the right-hand side expanded as in (b), the drive should be increased if possible and/or the inductance of the width coil reduced.

A still further condition is shown in (c), where the two sides of the pattern are reasonably balanced, but the centre is obviously compressed.

In general, aberrations near the centre of the pattern, whether distension or compression, call for adjustment of the horizontal linearity coil.

At the same time, adjustment of the linearity coil does have an effect on the overall width and it may be necessary to consider this if there is a tendency for the picture to be unduly wide.

In such a case, the best course is to select a setting for core in the linearity coil such that reasonable overall width is obtained without obvious aberration around the centre of the pattern.

FINAL ADJUSTMENT

Having thus adjusted the horizontal linearity, it may be necessary to modify the height and vertical linearity to produce a completely regular test circle. As noted earlier, the final adjustment should be made with the screen set to normal night-time viewing brightness.

Another point of note is that the deflection circuits and components have been designed to give a deliberate amount of overscan with the supply mains at 240 volts. The intention is that, when the supply voltage drops under heavy load conditions, as it does in some areas, the picture will not shrink markedly inside the mask.

The accompanying test pattern photograph indicates the order of scan to be expected from the receiver under normal operating conditions. Though we did

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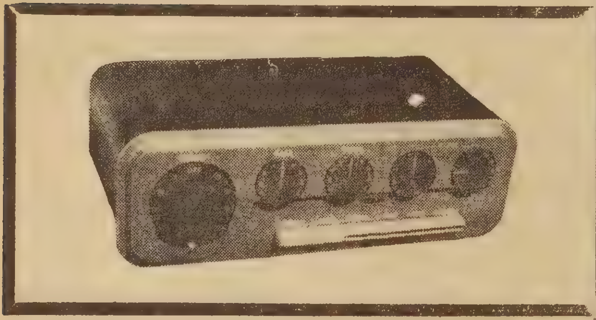

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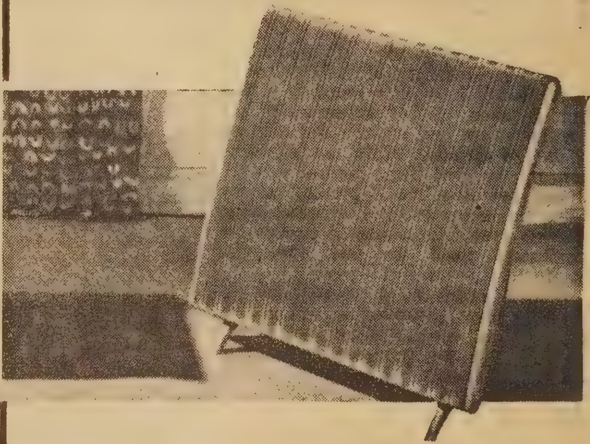

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______________________ [illegible]/10/59 not specifically try to do so, our impression is that it would be difficult to adjust for substantially smaller overscan without prejudicing the performance in other respects.

Having adjusted the linearity to your satisfaction, use the centreing magnets to shift the picture over to reveal the left-hand edge of the raster. If the picture information appears to be compressed or there is evidence of a slight foldover effect, some modification to the picture phasing is indicated.

As mentioned last month, this normally involves removing or reducing the 15pf capacitor shunting the 0.15meg. resistor in the horizontal oscillator feedback network.

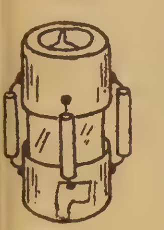
ALIGNMENT

To this point, or at least in this article, we have said nothing about alignment of the tuning system which is, of course, a subject of major importance. It was discussed, however, in the first article.

If you have bought a pre-aligned IF strip with tuner, it should receive pictures at first switch-on and superficially require no more than a possible touch-up of the slugs in the tuner oscillator coils, to centre the fine tune control. In no circumstances should the IF transformer cores be the subject of random "fiddling."

At the same time, it is unlikely that the response curve, so obtained, will be optimum and our advice was that readers should make prior arrangements to have the alignment checked by someone with the necessary sweep and marker equipment.

☆



A valve shield, split in half and connected by four 300-ohm resistors, provides an effective means of coupling capacitatively into the frequency changer valve for alignment purposes.

☆

Since this will normally be in the hands of persons experienced in its use, it should not be necessary to go into lengthy details about sweep alignment procedures. However, a few important points can be made, as under:

(1) The tuning system MUST be provided with fixed bias during the alignment procedure. Apply minus 3.0 volts to the IF strip and minus 4.5 volts to the tuner, in each case across the 0.47mfd AGC bypass. Use a bias battery or series-connected torch cells.

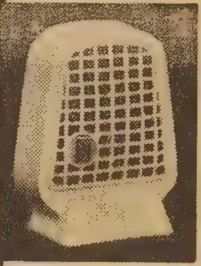
(3) It is wise to verify the accuracy of the signal generator used as the frequency marker, preferably by beating against a crystal standard. If the error exceeds 1 p.c., make due allowance for it. While some displacement of the IF channel may not, in itself, affect results, it may mean that cores have to be wound right in or right out of their coils, still without achieving the required alignment condition.

(4) Make sure that connection of the marker generator does not modify the curve shape as displayed on the CRO. If it does, it is better to give the curve, the final touch-up without the marker generator connected and relying on reference points marked directly on the CRO face.

(5) Beware of any situation where the curve shape varies widely with the position of leads, etc. This indicates standing waves on cables, due to ineffective earthing and lack of proper cable termination. The curve obtained under such conditions may differ considerably from what it really is in practice.

(6) Alignment is only completely valid when the IF strip and tuner are in position on the proper chassis, with normal voltages applied. Input should be to the tuner IF injection point. Alternatively, a special split valve shield can be made up as illustrated, bridged by four 300-ohm resistors. This gives adequate capacitive coupling into the mixer stage and, at the same time, terminates the generator cable.

(7) Check constantly to see that the input from the sweep generator is always well below overload at all points in its range. Overload is plainly evident if



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MONTHLY NEWS LETTER

Dear Friends.—We are beginning to feel that our readers have become personal friends, from the many appreciative letters received from those who look forward to our column of technical gossip and news.

We have this month a very small shipment of "Adcola" Soldering Irons in various models and as these have been a rare delicacy in past times, we feel that some of you may appreciate an opportunity to obtain one for yourselves.

We have noticed that many people when buying Stereophonic equipment are bringing along their own records for comparison and we feel that this is a very good idea, as going from showroom to showroom and listening to various recordings which each one possesses becomes extremely confusing. particularly when it is remembered that some discs being demonstrated have been chosen to give "gimmick" effects. If you are contemplating doing this yourselves, might we recommend a very fine recording suitable for this purpose, English Decca Number SP8390, "Starlight Chorale," with Roger Wagner conducting the Hollywood Bowl Symphony Orchestra and Chorus, containing a very fine selection of popular operatic works. For comparison work this disc is excellent, as it has an excellent surface as well as the channel separation, being very even throughout the recording.

Incidentally, for the sake of your records, don't forget with Stereo it is far more important now to constantly check your pickup weight and stylus condition, for slight abnormalities which were not so obvious in monaural equipment become doubly offensive in stereo.

If you have any doubts regarding the condition of your stylus, we would be only too happy to inspect it under a microscope for you and also test your pickup tracking, etc., this service of course, as usual, being free of charge.

We are happy to say that our prophecies regarding "Neat" equipment are being fulfilled and we now have many of these turntables, both synchonous and hysteresis models, installed in some of the biggest broadcasting studios in Australia. We also have a surprise this month from the same manufacturing house, a pickup arm Type GA4, which is a completely non-resonant tone arm adjustable to either 12in or 16in in length, where the horizontal free swinging is controlled by a pillar bearing at the rear of the arm, the arm being perfectly straight along its length, with the cartridge itself held in an offset mount on a second inside arm, which is very accurately balanced and counter-weighted. Serious users with unsteady hands can steady their hand on the arm itself, whilst swinging it across the record and then while selecting the required groove, depress the release and the stylus drops into the groove. This will be a boon to disc jockeys on the morning after and also to those who have precious recordings, which are easily damaged. Selling at under £10, we feel that this is real news. Plentiful supplies will be available towards the end of this month and would certainly make a nice Christmas box to yourselves.

Our Home Hi-fi Service Department is now operating in full swing in the Melbourne area and we trust some day you will take the opportunity to test out our efficient service, which, you will remember, covers everything from Hi-fi and Stereo, standard radiograms, tape recorders, and amateur gear to home cinema equipment, projectors, etc.

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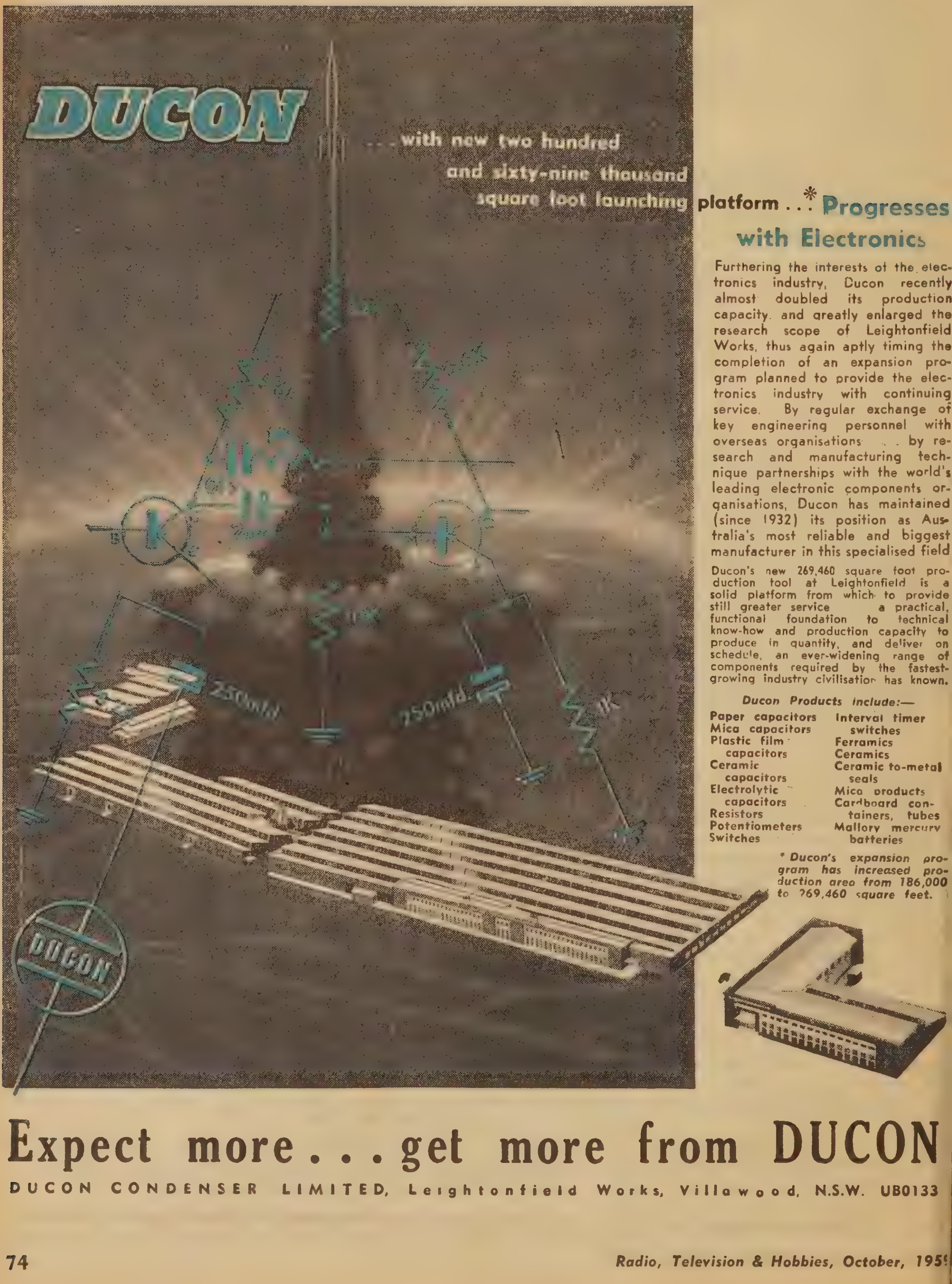

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Furthering the interests of the electronics industry, Ducon recently almost doubled its production capacity and greatly enlarged the research scope of Leightonfield Works, thus again aptly timing the completion of an expansion program planned to provide the electronics industry with continuing service. By regular exchange of key engineering personnel with overseas organisations . . . by research and manufacturing technique partnerships with the world's leading electronic components organisations, Ducon has maintained (since 1932) its position as Australia's most reliable and biggest manufacturer in this specialised field

Ducon's new 269,460 square foot production tool at Leightonfield is a solid platform from which to provide still greater service a practical, functional foundation to technical know-how and production capacity to produce in quantity, and deliver on schedule, an ever-widening range of components required by the fastest-growing industry civilisation has known.

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turning up the sweep generator output control causes peaks on the display to flatten off, as if against some invisible barrier.

(8) Never connect the CRO lead directly to the video detector or amplifier output. Always insert a carbon resistor right at the take-off point, of value not less than 47K. It may also stabilise behaviour of the equipment to insert a resistor in the lead connecting the sweep generator to the CRO.

Having aligned—or had aligned—the IF strip, the range of the fine tune control can be set. This should be done on the actual aerial with which the receiver is to be used. Reason for this is that signal strength has some reaction on oscillator tuning, if only by its reaction on operating voltage.

The normal tuning point for optimum picture reception is just clear of the setting which produces streaks in the picture in sympathy with the sound signal. It is convenient if this can be made to occur with the fine tune in the same central position for all channels. Tuning is then reduced to the simple operation of turning the selector switch.

OSCILLATOR CORE

Normal practice in turret tuners is to have the active oscillator coil opposite a small hole in the front of the tuner and above the knob line. The core is then accessible by means of a screwdriver, which is best shaped from a plastic knitting needle.

Make the tip fine and narrow so that it will fit into the core slot. Very little movement should be necessary and avoid exerting any more than a minimum of end pressure on the core. Set the fine tune shaft in the middle of its travel and try to adjust the oscillator cores for each of the three active channels, so that an optimum picture is obtained.

We yet have to discuss adjustment of the sound trap and sound system, even though it may well have been the first section of the receiver to be operating.

With laboratory instruments available, the best way of adjusting the sound trap in the video amplifier plate circuit is by feeding an unmodulated RF signal to the grid and measuring the output from the plate with a crystal probe attached to a VT voltmeter. Provided the signal generator is accurate, the trap can likewise be set very accurately also.

Failing the use of a generator and VTVM tune the receiver to a station and very close to the region where sound bars would become visible. Unless the trap happens already to be at 5.5 Mc. you will probably see a very fine herringbone pattern through the picture, with serrations along the line of about the same dimensions as the separation between lines.

Watch this pattern very closely and screw the core in the trap. You should pass through a setting where the pattern suddenly disappears. There should, in fact, be two such settings, corresponding to the two possible positions for the core.

If the trap does not have the expected effect, it may be missing out on 5.5 Mc and it would be worth trying again with a 10pF capacitor wired across its terminals. We had this experience with the prototype coil, presumably because the shunt capacitance was less than the manufacturer had allowed for.

(Continued on Page 127)

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Here's your answer, Tom!

Some of our readers must endow us with magical qualities for, as silly as the first query may appear, it is often asked us by budding enthusiasts. You can rest assured that if we ever design a perfect piece of equipment, we will be the first to tell you about it.

COULD you supply me with a circuit for a broadcast tuner including an RF stage, good selectivity and having perfect fidelity? A noise limiter would also be desirable and the circuit should not be too complicated.

We wish we could help you, Tom, but unfortunately we have not been able to design such a tuner to date, nor are we likely to do so for a long time to come.

The reason is that good fidelity cannot be obtained when the selectivity is also good and further it is very difficult to design a noise limiter that does not have an effect on the quality.

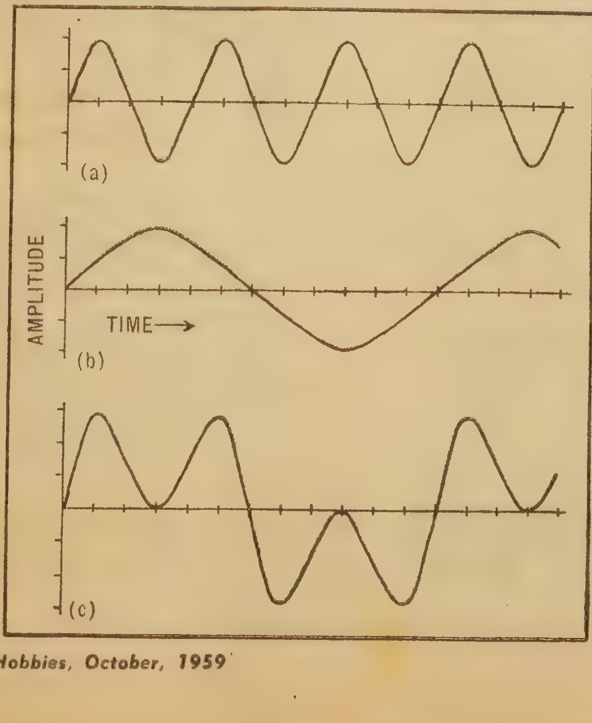
When a transmitter broadcasts a modulated signal, not only is the carrier wave present but also a series of sidebands. The position of these sidebands depends on the frequency of the modulation. The higher the modulation frequency, the wider are the sidebands displaced on either side of the carrier.

In order for a receiver to reproduce the higher modulation frequencies, it is necessary that the band width be sufficiently great to admit all the sidebands to pass, together with the carrier.

But, if you make the bandwidth great, then the chances of noise and in-terference from adjacent stations getting through also become greater. This means hat you can't get noise-free, high-quality eception from a radio station unless the signal is sufficiently strong to make the oise negligible. This in turn means hat you are usu-lly limited to local tation reception vhen using a wide and tuner or re-eiver.

*

f two frequencies epresented as (a) nd (b) are pres-nt simultaneously n an amplifier, they vill add to produce total voltage or one excursion as at c). Provided no on-linearity exists the system no dditional "beat" equencies are pro-uced and (a) and b) can always be esolved and often eard as distinct nd separate tones.



Dial lamps often burn out in receivers and I was wondering if it would help to prolong their life by connecting them to the 5-volt winding?

You are correct in your assumption, Tom. Connecting dial lamps to the 5-volt winding would prolong their life, but possibly at the expense of your own!

It works out this way: The 5-volt winding on the ordinary set is connected to the heater of the rectifier and, as such, becomes the source of the HT supply. Depending on the transformer voltage, etc., the rectifier filament, and hence the winding, may be anything up to 400 volts positive with respect to the chassis.

Normally a dial lamp appears to be and is a very innocuous device. Due to this, no precautions are taken for careful handling of the lamp when changing, etc., this being often effected while the power is switched on.

We shall leave you to imagine the reaction, and the after effects, when the harmless dial lamp and holder turn out to be a handful of high voltage, backed by a rectifier and a full filter capacitor.

Even if you were careful not to touch the lamp when changing, and there appeared no likelihood of anyone else doing so, there is every chance of the insulation breaking down under the strain and ruining the rectifier and possibly the power transformer. Dial lamp holders are made with enough insulation for the usual 6.3 volts, not 300 or 400 volts.

If you wish to extend the life of your globes, then either wire them in series or in parallel with a series dropping resistor feeding them. A small resistor, anything from 3 to 10 ohms, should be in order.

Situations do sometimes occur, where a 6.3-volt indirectly heated rectifier is used. Depending on the power transformer used, there may be a 5-volt winding left unused. In such a case, it is quite in order to connect the dial lamps to this unused winding and thus not only prolong their life, but also help to distribute the load evenly among the windings.

* * *

Can I prolong the useful life of my valves by reducing the filament voltage, assuming that I am willing to accept poorer performance?

No, Tom, definitely not. As a matter of fact you are likely to shorten rather than lengthen the life of the valves by reducing the filament voltage.

The exact reason for this is known as cathode poisoning. Apparently it is connected with the bombardment of the cathode surface by positive ions, when the space charge or cloud of negative electrons around the cathode is thinned out.

It is particularly important to operate the filaments of large, high-powered valves, at the correct voltage, since there is a greater chance of there being some residual gas in the valve. Also the emission requirements of the cathodes are likely to be greater.

In the early days when valves had tungsten filaments it was the accepted practice to control the gain of such valves by varying the filament voltage. The distortion introduced from other sources was so high that a little more did not matter and it was an excellent means of economising on battery drain, which was very high when compared with modern economical valves. But then tungsten filaments did not suffer from cathode poisoning to any degree

* * *

What is the difference between a directly and an indirectly heated rectifier? As far as I can see they both operate in the same manner.

In many applications, either a directly or an indirectly heated rectifier could be used. However, there are certain jobs where an indirectly heated rectifier is not only an advantage but a "must."

The most obvious application is in a vibrator receiver where it is desired to operate all the valve heaters from the one battery. Similarly, it may be used in a receiver where only one heater

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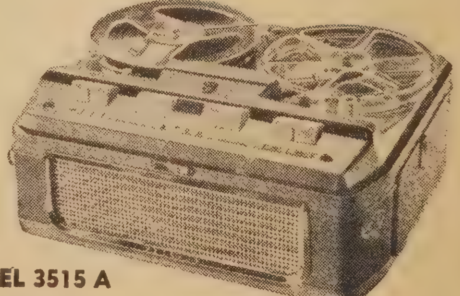

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winding is available. In these cases the insulation around the heater element is sufficient to withstand the high tension voltage. The 6X5 valve in the octal version and the 6V4 in the noval, are well-known examples.

There are a number of indirectly heated valves that are not designed to withstand a high voltage between heater and cathode and should be operated from separate winding. The cathodes of such valves are usually connected to one end of the heater.

The main difference between directly and indirectly heated rectifiers, apart from their construction, is that directly heated rectifiers such as the 5Y3 heat to full operating temperature much more quickly than the rest of the indirectly heated valves in a set. Consequently, there is a short period when the rectifier delivers full power while no power is being taken by the remainder of the valves, with the result that the voltage rises to a value well above normal.

The indirectly heated rectifier, on the other hand, takes about the same time to reach operating temperature as the remaining valves and the voltage never rises much above normal.

Last but not least the structure of an indirectly heated rectifier allows the plate to lie very close to the whole emitting surface. This reduces the voltage drop in the rectifier, between plate and cathode, and therefore makes for better operating efficiency and higher output voltage, all other things being equal.

★ ★ ★

How does one calculate the output from a rectifier valve?

Fortunately, Tom, this is something which you don't have to calculate.

It is possible to obtain the information directly from a series of curves usually found in a book of valve application data. Valve companies make these books available and in them you will find complete curves for the popular rectifiers and other valves. It is simply a matter of reading off the information you want from these.

Let's imagine that you want to know how much voltage you will get from a 5Y3 rectifier with 300 volts on the plates, a capacitor input filter and a current drain of 100mA.

Turn to the 5Y3 curves and pick out the one which is drawn for a capacitor input filter. You will see a graph with a set of sloping lines drawn across it marked "RMS Input Volts Per Plate" and the figures 400, 350, 300, etc. Since you are interested in the 300-volt line, you select this line.

The bottom line is marked "DC Load Milliamps," and, selecting the 100 mA line you follow it till it intersects the 300 volt input line. Following the intersecting point across to the vertical "DC Volts Output" scale you find that it corresponds to about 275 volts. This will be the voltage available at the rectiier filament.

★ ★ ★

If I were to connect a filament transformer, giving 6.3 volts from the power mains, to a vibrator set, would it function?

The answer is no, Tom, definitely not! The DC supply from the accumulator nergises the coil within the vibrator artridge, causing the reed to vibrate ack and forth at its fundamental freuency, which is approximately 100 ycles.

As the reed impinges first against one ets of contacts and then against the other, it sends pulses of direct current through the transformer primary, first in one direction and then in the other. These pulses set up corresponding voltages in the secondary, which are rectified either in the conventional manner by means of a rectifier and suitable filter, or by means of an extra set of contacts with which the vibrating reed connects.

Whatever the method used, the action of the vibrator is dependent on there being instantaneous and unidirectional pulses available from the driving source, which is the accumulator. If the accumulator were replaced by a 50 cycle filament transformer, the 50 cycle alternations would get hopelessly mixed with the approximate 100 cycle operation of the reed.

But even if the reed did manage to vibrate in some kind of step with the power mains, the voltage induced in the secondary would be anybody's guess.

★ ★ ★

Individual items such as a violin string, organ pipe, vocal cord, etc., can only vibrate at the fundamental frequency with, of course, their harmonics. How is it, then, that the single cone of a loudspeaker can reproduce a low organ note and at the same time a high violin note?

The answer to this question, Tom, is much more convincing if accompanied by a graphical illustration. To this effect we are including a sketch depicting two typical waveforms and their combination.

At (a) is a graph which, let us assume, represents a high violin note. The vertical axis represents amplitude, while the horizontal represents time. It can be seen that in the amount of time represented by the width of the diagram the string has been able to make a little over four complete oscillations.

At (b) is seen a note from another instrument, of much lower frequency. In the same amount of time it has been able to make a little more than one complete oscillation.

Now let us see what happens when the two notes are combined as in the case when the high note and the low note are fed through an amplifier. The result is seen at (c).

This new signal contains the intelligence of both signals. In fact, if you were to insert filters it would be possible to separate it into its original components. If you were listening to the combined signal, as reproduced by a loudspeaker, you could mentally filter the program by listening to either the high or the low note, as required.

The graph of the combined waveforms is quite valid and was obtained by algebraically adding the two simpler curves.

To accomplish this, you divide the horizontal axis of the graph into convenient portions of time and then find the amplitude of each of the waveforms at a particular time. An algebraic addition of the two will give a new figure of amplitude with which to plot the combined curve.

As an example, at one instant the note at (a) may have an amplitude of plus four divisions. At the same instant the note at (b) may have an amplitude of minus one division. The resultant therefore will have an amplitude of plus three divisions.

Carry this operation on at convenient time intervals throughout the period of time being analysed, and you will establish a series of points representing the

(Continued on Page 91)

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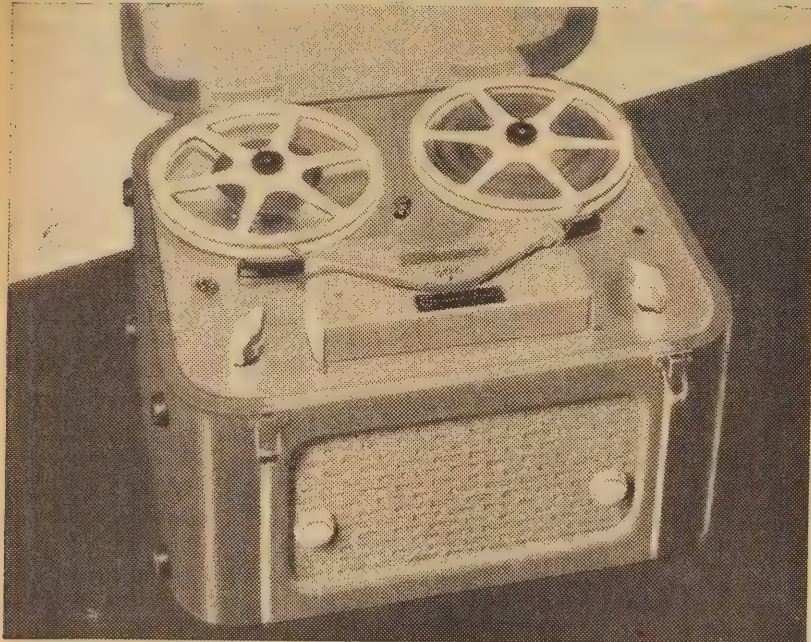

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RECTIFIERS BECOMING SMALLER

Silicon power rectifiers are finding increasing application in locally made equipment, but particularly in television receivers. Their characteristics are discussed in this article, prepared by engineers of the Aerovox Corporation.

IN the 17 years preceding World War II, the only semiconductor power rectifiers exploited commercially in significant numbers in the United States were of the copper oxide or magnesium-copper sulphide types.

These rectifiers were restricted, for the most part, to low-voltage applications such as battery charging, engine starting, electro-plating, loudspeaker field supply, and relay or solenoid operation.

Miniature copper oxide rectifiers were, and still are, employed to convert DC meters for AC operation.

Right after the war, the selenium rectifier, popular for some time in Europe, began to be manufactured in the U.S.

HIGHER VOLTAGES

Because a single selenium rectifier plate of given area and thickness of its active elements provides higher forward and reverse operating voltages than the copper oxide and magnesium-copper sulphide types, several such plates could be stacked in series for higher-voltage operation, fewer being required than with the two earlier types of rectifiers.

It was natural therefore that this rectifier found its first widespread application in the U.S. in transformerless radio receivers and amplifiers.

Selenium rectifiers soon began to be supplied in a wide variety of sizes with different current and voltage ratings.

By stacking a number of small rectifier "cells" in series, kilovolt ratings were achieved. Large-scale plates provide output currents up to several thousand amperes.

The merits of all solid-state rectifiers are obvious: instant operation since there is no heat-up interval; freedom from the heat caused by filament operation; increased mechanical ruggedness compared with that of tubes; unlimited operating life; smaller size than tubes in some instances; ability to operate at lower voltages; simplicity; greater current capability; higher over-all efficiency because of the absence of filament power.

LARGER SIZE

Disadvantages of the selenium rectifier are its large physical size for high current ratings, restriction to lower-frequency operation, sensitivity to high ambient temperatures, and relatively low peak inverse voltage ratings per rectifier plate.

These disadvantages are, of course, relative to performance of later solid-state rectifiers of other types. A further peculiarity of the selenium rectifier is its generation of a foul odour when accidentally burned out.

Following the development of the transistor, the germanium junction power rectifier appeared. This rectifier has the advantages of smaller size than the selenium unit, higher rectification efficiency, lower forward voltage drop, superior front-to-back current ratio, and considerably higher operating frequency.

However, it is sensitive to high ambient and junction temperatures and, because it is essentially a low-voltage device, several such units must be wired or stacked in series for high-voltage operation.

The silicon junction rectifier is the latest in the series of commercial semiconductor power units. Its characteristics suit it to many applications in industrial, military, and entertainment-type electronic equipment.

In addition to power rectification, the silicon rectifier, because of its unique DC characteristics, is utilised in other types of service such as voltage regulation, sequential switching, and equipment protection.

OFTEN PREFERRED

In some applications, this unit is replacing selenium and germanium rectifiers just as the selenium unit earlier supplanted the copper oxide type in many applications.

The following features are representative of contemporary, production-type silicon rectifiers.

In making comparisons with the selenium rectifier, the writers have no intention of disparaging the latter. It so happens that the selenium rectifier and its characteristics are well-known to a number of readers, since this rectifier has been so widely used.

1. SMALL SIZE. Since the silicon rectifier consists of a single junction, the absence of stacks for simple low-and medium-current units (and some high-current ones as well) and the ability of the single junction to dissipate significant amounts of power keeps the unit small.

A modern 3.5-ampere, 600-volt rectifier, for example, is only approximately 7/16in in diameter and 7/8in high, with a 10/32 mounting screw less than ¼in long on one end.

Compare this with a 500mA, 120-volt selenium rectifier which for one-fifth of the voltage and one-sixth of the current of the silicon rectifier is 3in long, 1¼in high, and 1¼in thick (over 14 times the volume of the silicon unit).

2. HIGH POWER CAPABILITY. The higher power handling capability per unit volume of the silicon rectifier will be evident from a comparison of a silicon and a selenium rectifier of nearly comparable rating: A typical 100 V, 750mA silicon rectifier having a volume of approximately 0.4 cu. in. supplies 74 watts of DC power.

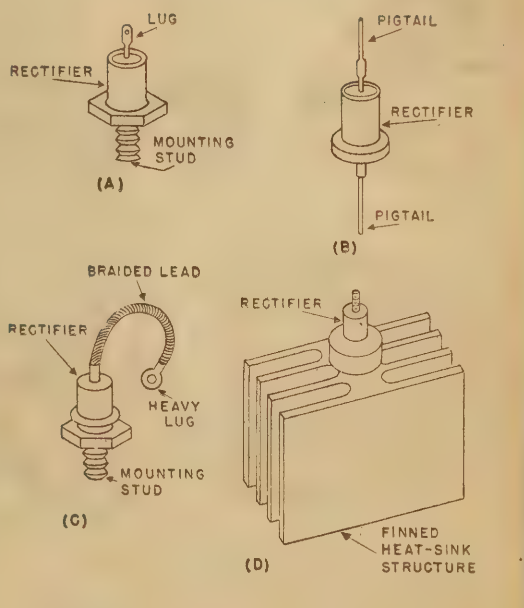
MUCH SMALLER

A 120V, 400mA selenium rectifier with 5.6 cu. in. volume supplies 57.5 watts. Thus, this silicon rectifier delivers 185 watts per cubic inch against 10½ watts per cubic inch for the selenium.

3. HIGH EFFICIENCY. Rectification efficiency (n) is defined as 100 times the ratio of DC output voltage (Eo) to peak AC applied voltage (Ei): n equals 100 (Eo/Ei).

For resistance-loaded half-wave rectifiers, n may be as high as 99 per cent for silicon rectifiers and 68 per cent for selenium at light loading. These figures vary, of course, with selenium rectifiers under various operating conditions and the gap may not be as great in some instances.

The voltage drop introduced by the rectifier when it is passing rated forward current is a function of the forward resistance at the operating voltage level.



SILICON RECTIFIER CONFIGURATIONS

FIG. 1

WAVEFORM

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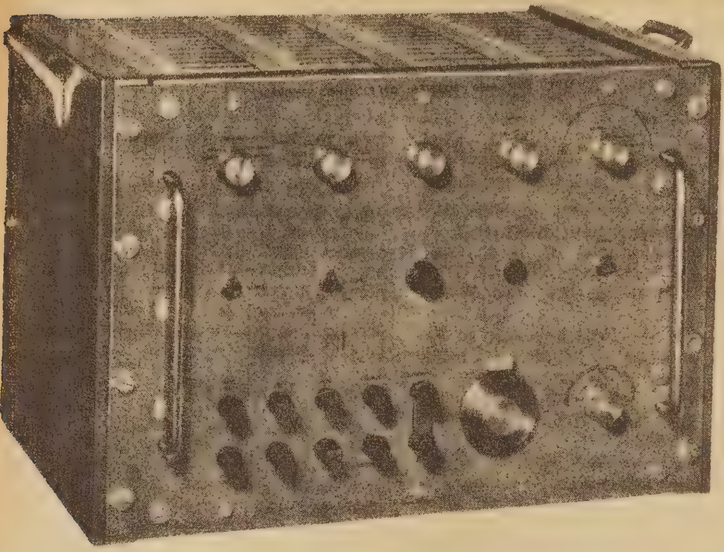

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This voltage drop influences the rectification efficiency in an inverse manner and contributes directly to internal heating of the rectifier.

In a silicon rectifier, the forward voltage drop may be of the order of 0.6 volt at 140v rms operating potential; in a small selenium rectifier consisting of five stacked plates, the drop may be 5 volts.

4. HIGH REVERSE (LEAKAGE) RESISTANCE. The maximum reverse (leakage) current through a silicon rectifier during the blocking period of the AC half-cycle of applied voltage is lower than that through a comparable selenium rectifier.

Thus, the reverse resistance of the silicon unit is the higher. Like forward voltage drop, reverse (leakage) current affects the rectification efficiency inversely and contributes to internal heating in the rectifier.

LEAKAGE CURRENT

In the low-current class, a typical silicon rectifier rated at 600 PIV and 3.5 amp DC output has a leakage current of only 2 microamperes at the rated operating voltage.

For a commercial 85-ampere, 210-volt silicon unit, the maximum leakage current is specified as 50mA. In the first case, the front-to-back current ratio is more than 1 million to 1.

5. REDUCED HEATING. It follows from (3) and (4) that internal heating will be lower in the silicon rectifier because of the low forward voltage drop and low reverse leakage current, provided all other factors and standards of comparison are equal. Low heating prolongs rectifier life and simplifies equipment packaging problems.

6. HIGH-VOLTAGE OPERATION. Special silicon rectifiers provide high-voltage operation in single units without stacking. Use of such compact units simplifies equipment packaging and circuit design.

Maximum peak inverse voltage ratings up to several kilovolts are obtainable in some types. Like other solid-state rectifiers, small-sized silicon cells also may be wired in series for higher-voltage operation.

7. HIGH-FREQUENCY OPERATION. The internal junction capacitance of the silicon rectifier is considerably lower than that of the wider-area, flat plate or disc of the selenium rectifier.

HIGHER FREQUENCIES

It is principally because of this feature that the silicon rectifier may be operated at higher frequencies than other solid-state types. 100 Kc operation is possible with silicon units, while the selenium rectifier (in power sizes, not small diodes) is restricted to power frequencies (e.g., 20 to 1000 cps).

8. GOOD TEMPERATURE CHARACTERISTICS. Silicon rectifiers are specified for safe operation from minus 55 degrees C. to plus 200 degrees C. Storage temperatures are specified for the same range. Some high-current types are provided with ventilating fins in single or stacked assemblies, and heat-sink mounting or forced-air ventilation is recommended for some applications.

Rectifier manufacturer's literature shows derating figures where these are applicable.

9. GOOD PACKAGING. Commercial silicon rectifiers are supplied in enclosed casing, principally of the stud (mounting-screw) and wire-in (pig-tail) types. They often are hermetically sealed.

Figure 1 (a) illustrates the stud type and Figure 1 (b) the pigtail type. Figure 1 (c) shows a stud-mounting high-current type provided with a flexible-braid lead and lug for heavy duty.

High-current types sometimes are provided with one-piece cooling structures, as shown in Figure 1 (d).

Figure 2 shows the typical plot of voltage vs current for a silicon rectifier. Note from this curve that the slope of the forward current is steep from zero to maximum, reaching a point If when the forward voltage is at the maximum permissible forward peak, Ef.

The reverse current is notably small; at first being only a few microamperes in low-current types and a few milliamperes in medium and high-current types, from zero to the reverse voltage level Ez.

At the potential Ez (termed the Zener voltage), the reverse current increases sharply reaching a high level, Iz, during the small voltage increment Ex. Ez.

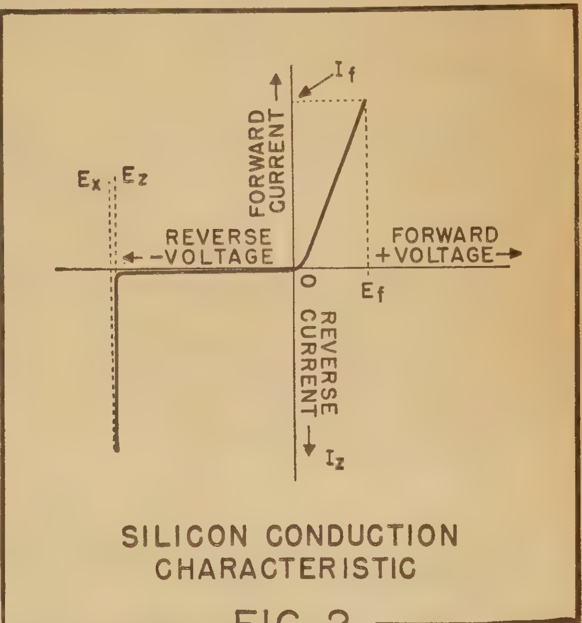

FIG. 2

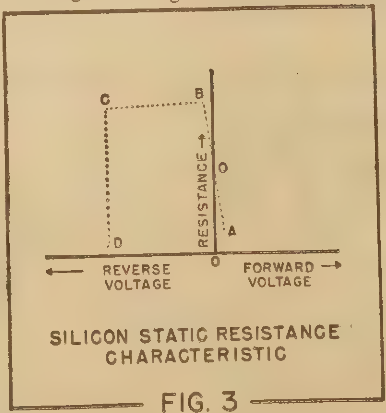

FIG. 3

While this sudden increase in current resembles a breakdown, and often is so termed, it causes no damage to the rectifier if the maximum current and dissipation ratings are not exceeded.

This "breakdown" is of especial interest in silicon rectifier applications; because the increase in voltage drop across the rectifier from Ez to Ex is virtually negligible as the current makes a rather heavy excursion to Iz. the silicon rectifier operated at its Zener point may be employed as a voltage regulator or as a voltage reference.

The resistance and dynamic impedance of the rectifier are very low in the Zener region. Some rectifiers are fabricated especially for such applications and are termed Zener diodes. In these units, the breakdown point occurs at a specified voltage.

In standard rectifiers, Point Ez is sufficiently higher than the maximum rated peak inverse voltage of the units that the negative half-cycle of applied voltage never swings into the Zener region in normal operation. The desirable high front-to-back current ratio of the rectifier accordingly is maintained.

Figure 3 shows the static resistance characteristics of the silicon rectifier. This plot corresponds to the El conduction characteristic depicted by Figure 2. The resistance axis in Figure 3 is assumed to be logarithmic and to cover the range from less than 1 ohm to several megohms.

As forward voltage applied to the rectifier is increased from zero, the rectifier resistance decreases sharply to a low value (a) at maximum permissible forward voltage.

When the reverse voltage is increased from zero, the rectifier resistance rises rapidly to a high value (b) and then decreases almost imperceptibly as the voltage is increased to C.

As the voltage is increased a very small amount higher than at Point C, the resistance drops abruptly to a low value (D). since C represents the Zener point.

Low, medium and high-current silicon rectifiers are supplied in single-diode units which may be operated singly or in multiples with high efficiency in conventional power supply circuits.

POSSIBLE CIRCUITS

The latter include single-phase and polyphase half-wave and full-wave arrangements. Single rectifier cells may be connected in series for higher operating voltage and in parallel for higher current.

Voltage multiplier circuits, such as doublers, triplers and quadruplers also may be used.

In addition, high-current silicon rectifier stacks are available in the following arrangements: (1) single-phase full-wave centre-tap, (2) single-phase bridge, (3) single-phase magnetic amplifier bridge, (4) three-phase half-wave, (5) three-phase bridge, and (6) six-phase star. These arrangements are shown in Figure 4.

To obviate repetition, the complete power supply circuitry, including transformer, filter and load, is not shown

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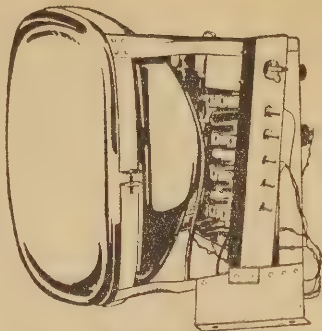

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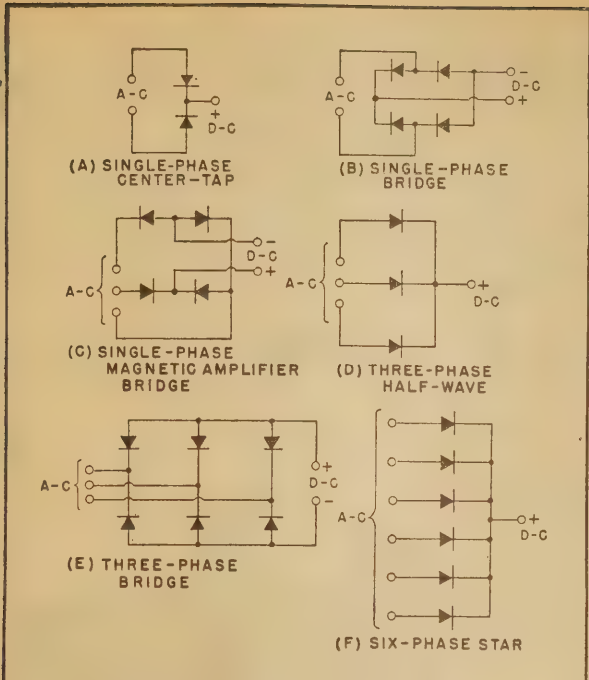
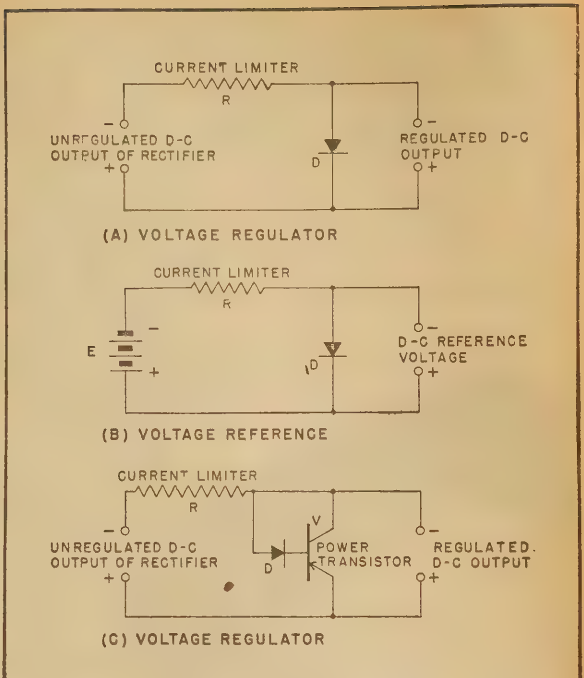

A-C
+
D-C
(A) SINGLE-PHASE CENTER-TAP
A-C
-
D-C
+
(B) SINGLE-PHASE BRIDGE
-
D-C
+
A-C
(C) SINGLE-PHASE MAGNETIC AMPLIFIER BRIDGE
A-C
+
D-C
(D) THREE-PHASE HALF-WAVE
A-C
+
D-C
-
(E) THREE-PHASE BRIDGE
A-C
+
D-C
(F) SIX-PHASE STAR

STACKED RECTIFIER ARRANGEMENTS

FIG. 4


CURRENT LIMITER
R
-
UNREGULATED D-C OUTPUT OF RECTIFIER
+
D
-
REGULATED D-C OUTPUT
+
(A) VOLTAGE REGULATOR
CURRENT LIMITER
R
E
-
+
D
-
D-C REFERENCE VOLTAGE
+
(B) VOLTAGE REFERENCE
CURRENT LIMITER
R
V
-
UNREGULATED D-C OUTPUT OF RECTIFIER
+
D
POWER TRANSISTOR
-
REGULATED D-C OUTPUT
+
(C) VOLTAGE REGULATOR

ZENER UNIT APPLICATIONS

FIG. 5

here, since this circuitry is standard and may be found in any electrical handbook.

Single high-current silicon rectifier cells are commercially available for single-phase half-wave operation with resistive or inductive loads to deliver up to 293 amperes output and up to 1,120 volts rms input.

For resistive or inductive loads, single-phase centre-tap stacks are available up to 438 amperes and up to 280 volts rms input, single-phase bridges 219 amperes and 250 volts, single-phase magnetic amplifier bridges 219 amperes and 250 volts, three-phase half-wave stacks 380 amperes and 186 volts, three-phase bridges 190 amperes and 376 volts, and six-phase stars 338 amperes and 188 volts.

Figure 5 shows typical applications of silicon rectifiers designed and fabricated for specified values or reverse-voltage breakdown (Zener point).

TYPICAL CIRCUIT

Figure 5(A) is the circuit of a simple DC voltage regulator. In this arrangement, the Zener rectifier, D, behaves in a manner comparable to that of the VR-type of gaseous regulator tube. The current-limiting resistance, R, is chosen such that the diode reverse current is held within the Zener region (that is, between Ex and Ez in Figure 2).

The voltage drop across the diode consequently is fairly constant for large changes in the DC voltage applied to the circuit and for load current changes. The DC output voltage accordingly is regulated.

Figure 5(B) shows a simple DC voltage reference ("standard cell") circuit. This arrangement behaves similarly to the voltage regulator in Figure 5(A). That is, the voltage drop across the Zener rectifier, D, is constant for large changes in the supply voltage, E. This diode voltage constitutes the stable DC output.

For best results, Voltage E should be large with respect to the DC output voltage (Rectifier Zener voltage), resistance R should be high and external loading should be light with reference to the Zener current flowing through the rectifier.

Figure 5(C) shows a regulator of the amplifier triode type employing a power transistor, V. The DC base current of this transistor is supplied through the Zener rectifier, D, which is held in its

(Continued on Page 127)

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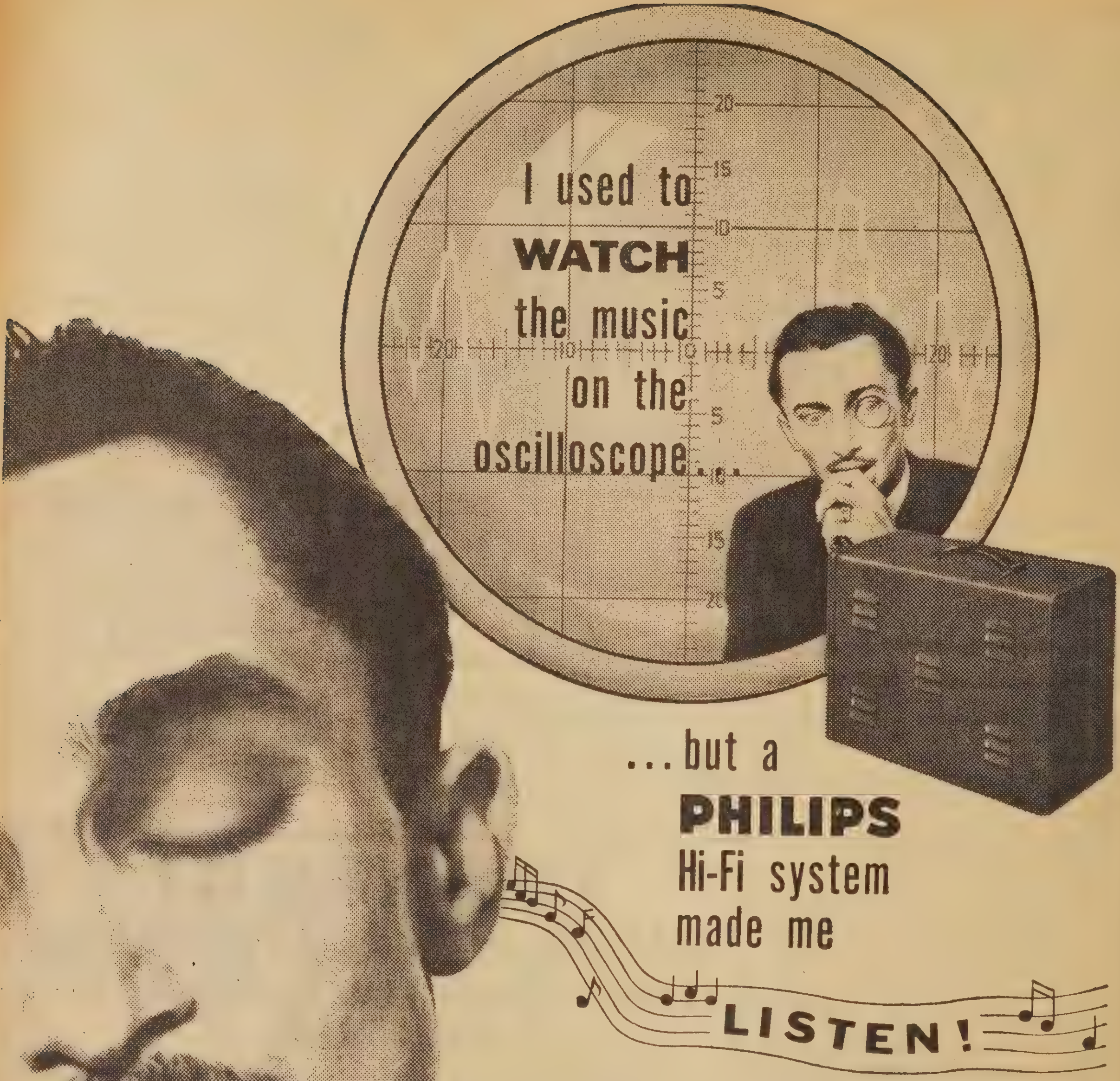

Every time I bought a record, I used to set up the calibrated microphone, connect the oscilloscope, start the music with bated breath, and — consumed with anxiety — I would keep my eyes glued to the screen of the cathode ray tube. If anything on the 'scope pattern looked suspicious (something always did), I would start checking tubes, voltages and crossover frequencies, and examine the record grooves under a microscope.

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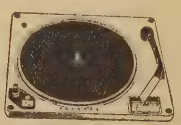

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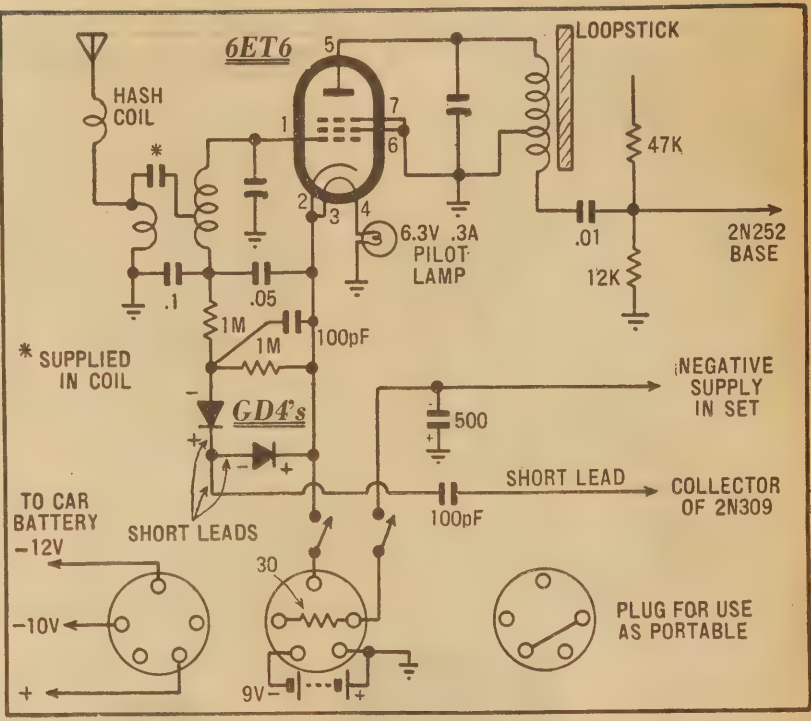
Many readers will be interested in the comments of Mr. E. Robertson of 5 Narwee Rd., French's Forest, N.S.W. who has constructed a receiver for dual use as a self-contained portable and as a car radio. Mr Robertson writes:



FOR some time now I have been interested in constructing an all transistor car radio that could also be used as a portable and I have waited patiently for R. TV and H. to produce such an article. I was therefore disappointed when your car radio did eventually arrive, as it still used power consuming valves.

(The hybrid valve/transistor system is still the most satisfactory means of producing a car receiver for the reasons given in the article. Ed.)

"I decided to try a compromise and use 1 valve in an RF stage which would only be used when connected to the car battery.

VALVE TYPE

"The obvious choice of valves would be a 12BL6 or a 6ES6. However, I found these unprocurable and settled with a 6ET6. Experiment with this tube showed that characteristics approaching remote cut-off and suitable for AVC application could be obtained if both the screen and suppressor grids are connected to 12 volts.

"The AVC voltage derived from one diode was only in the order of 1 volt with maximum permissible signal whereas 5 volts are required to make use of the tube characteristics which vary from a gm of 1500 at 0 volts on the control grid to 75 with —5.2 volts.

"I tried voltage doubling and connecting directly to the collector circuit instead of the output of the last IF. The resultant voltage from this arrangement was —5 volts with maximum signal without overload.

"When using the set as a car radio the valve filament is energised in series with the dial lamp and the RF stage becomes operative.

"When used as a portable, a separate shorting plug is employed to connect on internal 9 volt battery to the transistor section only.

"There is a catch, however, with regard to the coils. The loopstick and oscillator coils were designed to tune with a 300 pf condenser and the RF (Q plus AC7) with a 425 pf. To obtain tracking it was necessary to remove 2 plates from one end of each of the loopstick and oscillator sections rotors of the gang."

(Coils designed to track with a 425 pf capacitor are available and are, in fact, the types recommended for our Transporta Seven. Ed.)

"The set is contained in a wooden case which, in turn, is placed in a metal compartment when the set is used in the car.

"Some rearrangement of the bias to the 2N252 transistor was necessary as shown in the accompanying diagram."

STEREOPHONIC SOUND NEED NOT BE EXPENSIVE

Mr. Woods, of Peat Island, Hawkesbury River, N.S.W., tells how he made an effective stereo system for little outlay.

"THIS article concerns a cheap stereo-playback system. Assuming that a reader has a reasonably good record player this system could be constructed for about £25, which was all I paid out in cash. The rest was a few hours of work. It was worth it.

"Starting with the record player, I checked for speed accuracy and got rid of as much noise in the motor and turntable as I could and, then, finally cleaned and lubricated all parts. I removed the original cartridge, replaced it with a stereo cartridge, which retailed at just under £5. Also, I had to insert an extra pair of pick-up leads for the second channel.

"Next came the problem of the amplifiers. Along to a local second-hand radio dealer I went and purchased two old console radios. These cost £4 altogether.

"Then work started. First I removed the chassis and cleaned them off. Then I disconnected the radio stage of both and hacksawed the unwanted portion of chassis off. This I did to reduce size. I then had to remount the volume control in a position next to the tone control, for in both cases they were on the waste end of the chassis. I then proceeded to change the circuitry a little to incorporate separate bass and treble controls on both chassis.

"Last on the list came the speakers. For these I went 'the whole hog,' so to speak. I let my head and my money go on two cheap, good quality

(Continued on Page 117)

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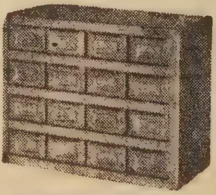

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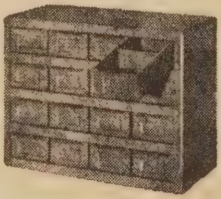
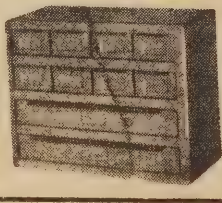


MODEL D
52/-
Cabinet 12" x 9" x 5½" 8 drawers 5½" x 2⅝" x 1½". 2 drawers 11" x 5½" x 1½".



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ONE TV AERIAL — SEVERAL SETS?

By R. Lackey S.M.I.R.E. (Aust.)*

The occasion will sometimes arise where it is desirable to operate a number of television receivers from the one receiving aerial.

IN reasonably good signal areas, an efficient high-gain aerial such as Type 215 will provide sufficient signal strength to operate a number of sets.

(For those not familiar with the 215, it combines a three-element yagi for the low band and a six-element beam on the high band.)

As a general rule, it is not practicable to connect several sets in "parallel," because the resulting mismatch in impedance will cause multiple reflections of energy to and fro in the line, resulting in blurred images.

OSCILLATOR RADIATION

In addition, there will almost certainly be sufficient coupling between receivers to allow oscillator radiation to produce mutual interference, resulting in spurious patterns on the screens.

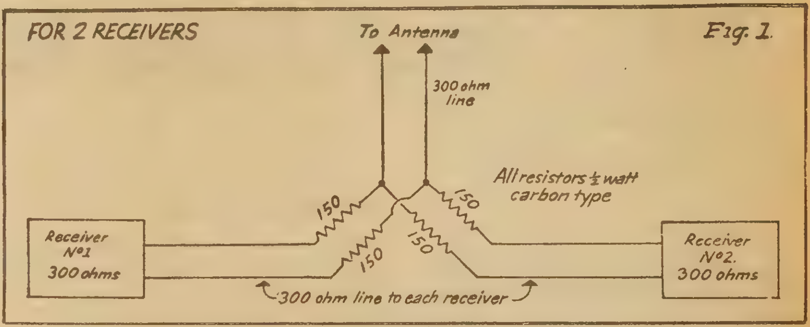
The problem thus becomes one of dividing signals in such a manner that each length of line is terminated at the receiver end by a load approximately equal to its characteristic impedance.

At the same time oscillator radiation must be attenuated.

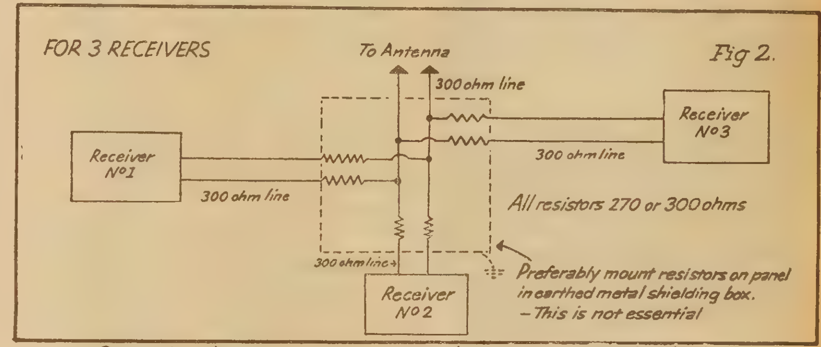
The simplest method of multiple operation for two, three or four receivers each having 300 ohm input impedance is shown in Figs. 1, 2 and 3.

For five receivers the principle is the same, but 560 or 600 ohm resistors should be used; for six receivers, the resistors should be 680 or 750 ohms each.

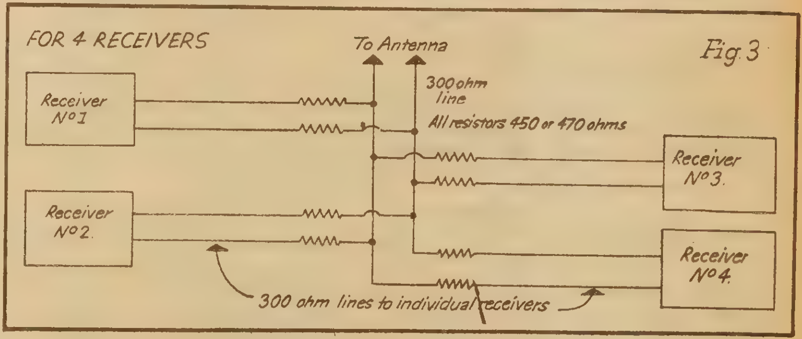
In the case of Fig. 2, for example, the addition of two 300 ohm non-inductive resistors to the 300 ohm receiver input increases each line impedance to 900 ohms, but the three sub-circuits in parallel present a combined impedance of 300 ohms, to correctly terminate the feeder line from the aerial.


FOR 2 RECEIVERS
To Antenna
Fig. 1.
300 ohm line
All resistors ½ watt carbon type
150
150
150
150
Receiver No1 300 ohms
Receiver No2. 300 ohms
300 ohm line to each receiver

Connecting two receivers to one aerial, using a 300-ohm feeder system.


FOR 3 RECEIVERS
To Antenna
Fig 2.
300 ohm line
Receiver No3
Receiver No1
300 ohm line
300 ohm line
All resistors 270 or 300 ohms
300 ohm line
Receiver No2
Preferably mount resistors on panel in earthed metal shielding box. – This is not essential

Connecting three receivers to one aerial, again using 300-ohm feeders.


FOR 4 RECEIVERS
To Antenna
Fig 3
300 ohm line
Receiver No1
All resistors 450 or 470 ohms
Receiver No3.
Receiver No2.
Receiver No4.
300 ohm lines to individual receivers

The same basic principle is followed to supply four individual receivers.

USEFUL ISOLATION

At the same time the resistors provide a useful measure of isolation between receivers.

To preserve correct loading, if any receiver is disconnected from its individual line, a 300 ohm non-inductive half-watt or one-watt resistor should be connected across the end of the line.

Do not leave the end of an unused line either open or short-circuited.

In some locations, 300-ohm twin wire line is unsatisfactory because it picks up considerable interference from industrial electrical equipment, from nearby neon signs or from motor vehicle ignition systems.

This condition is most likely to arise where it is necessary to run a line down the front wall of a shop or building on a main road.

Again, there may be instances where more effective supression of oscillator radiation is desired.

In all such cases, an arrangement which employs co-axial cable, may be used, as shown in Fig. 4.

The shielding effect of the outer metal braid will normally improve the conditions mentioned but will attenuate the signals to a somewhat lower level than with the system illustrated in Figs. 1 to 3.

The Antiference Type 215 aerial, although designed to feed into a 300 ohm line may be directly fed into a 72 ohm co-axial line without the necessity for a matching transformer or "balun" with its associated losses.

In Fig. 4, the 72 ohm line is terminated in a 75 or 82 ohm non-inductive ½-watt or one-watt resistor to prevent reflections of energy back up the line.

OTHER RECEIVERS

Each receiver, up to a total of six, is connected to the 72 ohm line by means of a "pad" similar to those shown in Fig. 4. Resistor values can be the same regardless of whether two or six sets are conected.

The 680 ohm resistors are high enough to prevent each set loading the line unduly and to isolate each set against oscillator radiation from the others.

Receivers having a 300 ohm input im-

---

* *Chief Engineer, Antiference (Aust.) Pty. Ltd.*

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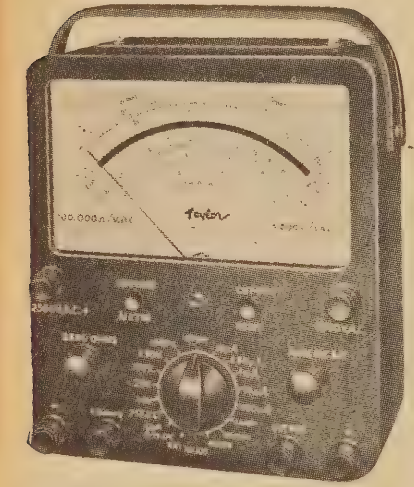
20,000 OHMS PER VOLT
HIGH SENSITIVITY



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SPECIFICATION:

Sensitivity: 100,000 o.p.v DC
5,000 o.p.v. A.C.

D.C. Current:
10uA, 50uA, 250uA, 1mA, 100mA, 1 Amp, 10 Amps.

Volts:
D.C. (8 ranges) 0.5-2500 volts. (25,000 volts by means of an external adaptor—model 400.)
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Resistance:
0-2000 ohms, 0-200 kilo-ohms.
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Decibel Ranges: =10 db to + 15 db.
(reference level 6mW in 500 ohms)
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Scale: 5in long, fitted with an anti-parallax mirror.

Overload Protection: A new patented design of an automatic mechanical cut-out is fitted.

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Dimensions: 8¼in x 7½in x 4½in.

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MODEL 127A

Designed to give a performance normally associated with expensive instruments, this POCKET-SIZE multimeter has a particularly high accuracy, coupled with a sensitivity of 20,000 o.p.v.

Sensitivity: 20,000 o.p.v. D.C.
1,000 o.p.v. A.C.

Current Ranges:
50uA, 1mA, 10mA, 100mA, 1 Amp.

Volts:
D.C. (7 ranges) 0.3-1000 volts. (25 kv by means of external adaptor, model 427)
A.C. (5 ranges) 10-10,000 volts

Resistance: 0-2,000 ohms, 0-200 kilo-ohms. 0-20 megohms.

Accuracy:
D.C. ranges 3% F.S.D.
A.C. ranges 4% F.S.D.
Ohmic range 5% centre scale

Scale: 3¼in long, having a knife edge pointer.

Dimensions: 5¾in x 3¾in x 1¾in.
Weight: 14oz.

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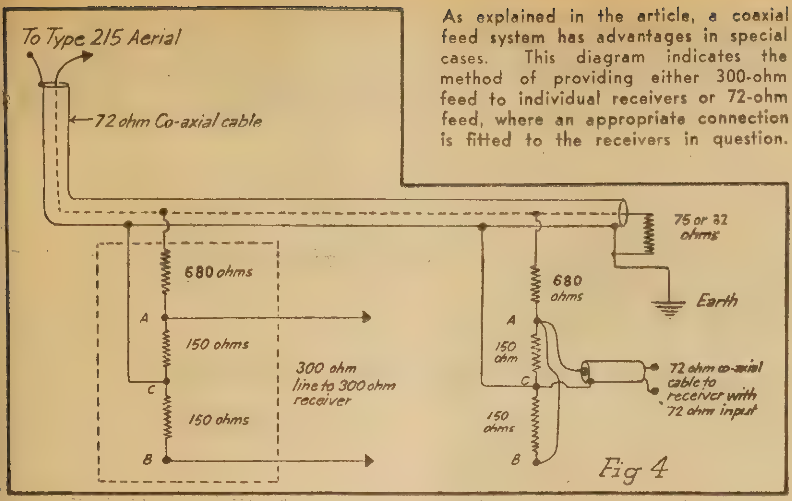

As explained in the article, a coaxial feed system has advantages in special cases. This diagram indicates the method of providing either 300-ohm feed to individual receivers or 72-ohm feed, where an appropriate connection is fitted to the receivers in question.

pedance are connected, as at the left of Fig. 4, to terminals "A" and "B" of a pad.

Any receivers designed for 72 ohm input impedance should be connected by co-axial cable to a pad with terminals "A" and "B" connected together and to the inner conductor, whilst the outer braiding should be connected to terminal "C."

MIXED IMPEDANCES

With the system in Fig. 4 it is possible to have a mixture of 300 ohm and 72 ohm receivers operating at the same time.

If any receiver is disconnected, it is not necessary to connect a "load" in its place, as the line itself is properly terminated.

For the system shown in Figs. 1 to 3, it is best to group all the resistors together in one location with individual lines radiating out to each receiver.

With the system of Fig. 4, the individual pads should be located near each receiver and should be connected to the main co-axial line at points as widely separated as possible.

AERIAL POSITION

Special care should be taken in locating an aerial for a multiple receiver system, to place it in a high position well clear of power wires, neon signs or other sources of interfering signals.

A separation of at least 10ft between the aerial and power wires is desirable and preference should be given to mounting the aerial on the side of a building away from a roadway where motor vehicle ignition interference is likely to be severe.

A range of two, three and four way splitters, housed in plastic boxes and already fitted with correctly proportioned resistors are available from Antiference (Australia) Pty. Limited or regular Wholesale Houses.

HERE'S YOUR ANSWER, TOM!

(Continued from Page 79)

resultant amplitude of the new waveform.

Provided the time intervals are not too far apart, the points will be close and the curve drawn through them will be smooth.

In practice, both the components and the resultant are usually much more complex than the given examples, due to the presence of harmonics. But however complex the wave form, the speaker cone attempts to follow them. Of course there is a limit to what the cone of a practical loudspeaker is capable of doing and the sound may not always be an exact replica of the original—but it can be very close, as evidenced by the sound which emerges from any high fidelity reproducing system.

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INSULATION: Moulded from high impact polystyrene—long surface track path.

SAFETY: No exposed parts.

SECURITY: Bush keyed internally to shaft and externally to panel. Cannot be loosened or unassembled from front of panel.

STRENGTH: No thread on contact section of spindle to foul cable or weaken post.

CONDUCTIVITY: Connections solder direct to turreted tip of spindle — no solder lugs, screws or washers to introduce resistance. Solid brass throughout.

BANANA SOCKET: Standard 5/32".

CAPTIVE HEAD: Moulding actually shrunk on to threaded insert — will not loosen.

DIMENSIONS: Overall 2" (one inch above panel) by ½" diameter. Screw capacity ⅛" — surface contact area 7/16" diameter.

MOUNTING: 5/16" hole with 1/16" radius external key way. Fits panels from 1/16" to ⅛".

COLOURS: Red and Black.

BANANA PLUG & SOCKET

PLUG: Split shaft 5/32" x ½". Overall length 1⅜". Solder connection optional—takes 10/010 cable with O/D. to 3/16". Colours — Red and Black.

SOCKET: Features same keyed mounting as terminal — fits panels 1/16" to ⅛". Solder connections direct to turret tip of solid brass receptacle. Overall length ⅝" (3/16" above panel) by ⅜" diameter.

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The AMAZING **DUSTBUG** **AUTOMATIC RECORD CLEANER**

reduces surface noise and record wear

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- ★ Suitable for all types of records.
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- ★ Wear of record and stylus greatly diminished.
- ★ Power of attracting dust removed.

The DUSTBUG is mounted on a completely independent miniature arm and, tracking the record, collects all dust and discharges static immediately in the area of the reproducing stylus. Regular shipments are now arriving.

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TRADE REVIEWS AND RELEASES

TAYLOR MODEL 94B IS PATTERN AND SWEEP GENERATOR COMBINED

Television servicemen needing a compact instrument for fault checking and routine alignment of receivers would do well to consider the Taylor Model 94B TV Waveform and Alignment Generator.

FACILITIES which would normally require two separate instruments are included in the 94B which sells at £165 plus sales-tax, where applicable.

As a pattern generator the instrument offers a choice of black to white graduation horizontally across the screen, horizontal bars, definition grid, cross grid, black raster and white raster. The last two are of value in assessing AGC and video operation since, by switching between the two it is possible to observe the resultant change in brightness, as well as measure resulting changes in voltage levels.

AUSTRALIAN STANDARDS

The instrument delivers an interlaced signal which closely approximates the Australian television standards and therefore gives a realistic impression of the behaviour of the receiver.

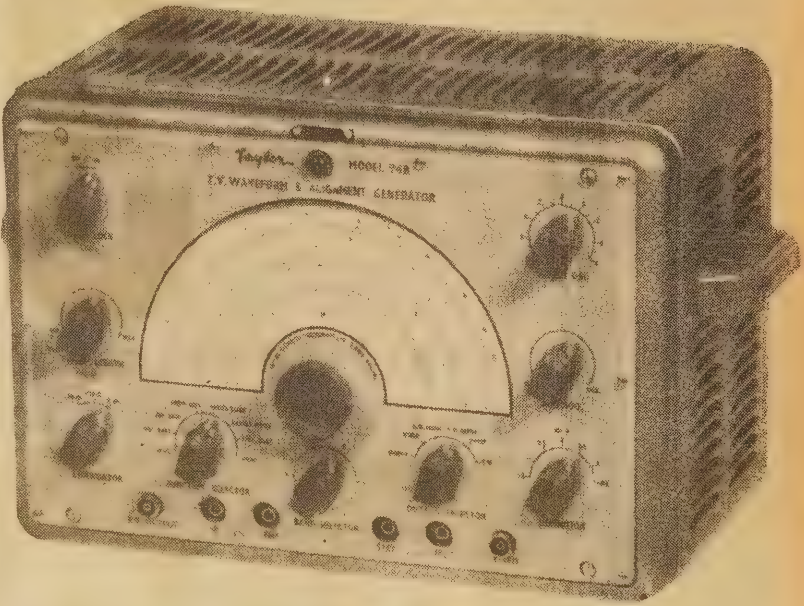
The output selector offers a choice of positive or negative video modulation, AM sound, FM sound, sweep or CW.

Carrier frequency is variable from 4 to 220 Mc in six bands. The sweep length used for alignment is also variable as is the width of the bars in the definition grid.

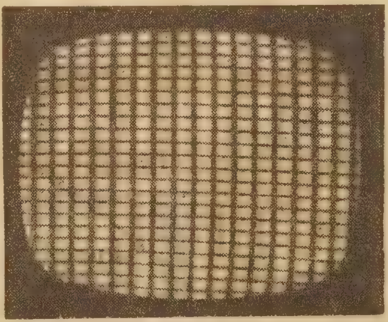
Tests on our latest television receiver were made with the 94B. A photograph from the screen showing the cross grid pattern is reproduced here. Other patterns obtained with the Taylor instrument appear on page 65.

We were quite happy with the pattern generator performance and although time did not permit an adequate assessment of its usefulness as a sweep generator, we see no reason why it would not be of value in this department also.

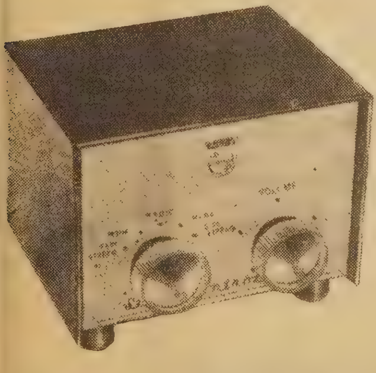
Inquiries should be directed to Jacoby, Mitchell and Co., of 469 Kent Street, Sydney.



Ease of operation has obviously been considered in laying out the panel for the Taylor 94B pictured above. The cross grid pattern, photographed from our TV receiver, is shown below.



PHILIPS EV4407 STEREO CONTROL UNIT



The Philips stereo control unit. Dimensions are 5in by 3 7/8 by 4in high

FINISHED in black enamel with gold inlay knobs and front panel, the EV4407 control unit is designed to match the Philips EV4430 amplifier. It can, however, be used with any two monophonic amplifiers to give a complete stereo system conveniently controlled from a single point.

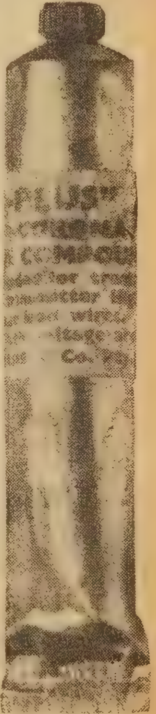
The unit is provided with a 5-position program selector switch giving a choice of stereo or mono tape input, radio and stereo or mono disc input.

All input and output connections are made on a terminal panel at the back of the cabinet. A loudspeaker phasing switch is provided.

Units are available immediately and the retail price is £8/15/6.

ANTI-CORONA SILICONE COMPOUND

R. W. STEANE and CO. PTY. LTD., of Hawthorne East, Victoria, have recently released a silicone compound which is effective in eliminating high voltage corona discharges in many cases.



The compound is particularly applicable to the EHT circuits of television receivers where discharges are likely to occur in humid weather. It should be applied around the high voltage anode cap of the picture tube and/or appropriate components in the EHT box.

Silicone is an excellent insulator and at the same time, tends to repel moisture.

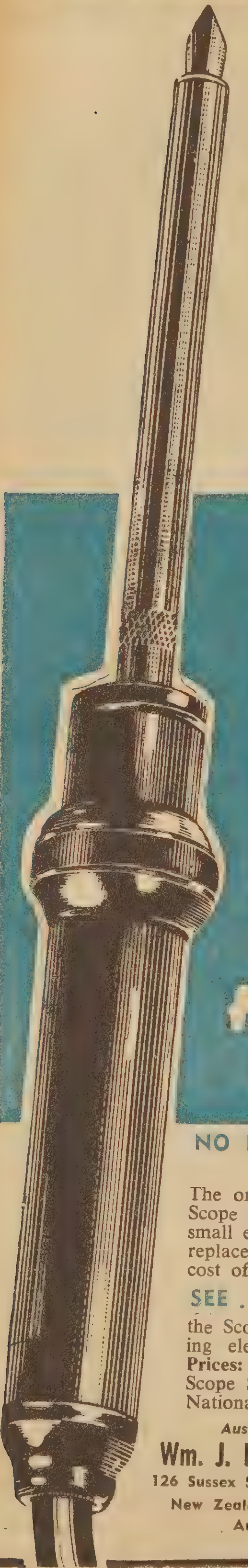
It is also a good conductor of heat and useful for improving the heat conductivity between transistors and heat sinks.

The silicone compound is available from trade houses. The price is 13/4, plus tax, for a tube containing approximately 2oz.

No wrist fatigue with SCOPE

weighs 3½ OZS.

...yet performs the functions of irons rating to 150 watts!



SCOPE
SOLDERING IRON

HOT in 6 seconds!

NO EXPENSIVE REPLACEMENTS

The only "consumable" parts in the Scope Iron are the copper tip and small element, both of which can be replaced easily by the owner at a cost of a few pence.

SEE . . . TRY . . . COMPARE

the Scope Soldering Iron at all leading electrical and hardware stores.

Prices:

Scope Soldering Iron	50/-
National Scope Transformer ..	49/7

Australian and Overseas Agents:

Wm. J. McLELLAN & CO. PTY. LTD.
126 Sussex St. (nr. King St.), Sydney. BX1131
New Zealand Distributors: H. W. Clarke
Auckland and Wellington

NO HEAVY CABLE

The Scope Iron is fed from a low voltage transformer or 4-6V accumulator via a special multi-strand 2-wire cable that gives maximum flexibility.

NO DANGEROUS VOLTAGE

The Scope Iron gives maximum safety in that it operates from extremely low voltage. The National Scope Transformer available with the iron has an output voltage of 3.3V and is especially designed for maximum protection on the mains input side. The National Scope Transformer is fully approved under Prescribed Articles of the Electricity Authority. Approval No. N/156.

NO WASTED TIME IN HEATING

The Scope Iron heats instantly, attaining full operating temperature in 6 seconds.

SCOPE LABORATORIES MELBOURNE

FERRIS FRINGE AREA TV RECEIVER

The Ferris Model C21F Special TV receiver designed for optimum reception in weak signal and areas subject to interference.

Generous video and sound IF channels plus a noise gate and sync. clipper are the main features of a special television receiver designed by Ferris Bros. of 752 Pittwater Rd., Brookvale, N.S.W.

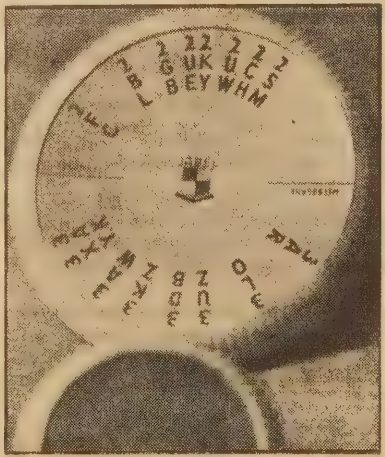
THE receiver has a 21in picture tube and retails at 205gns. It is available hrough the normal outlets.

In the video IF section, the four stages permit the maximum gain while maintaining the optimum response characterstic. Two sound IF, stages ensure that the limiting circuits are fully saturated and that the sound detector does not respond to amplitude modulation components which comprise most of the interference.

Weak signals were simulated in our own laboratory with the aid of a screen room, while interfering signals were created with an unsuppressed electric pistol drill.

Comparison with other receivers under these conditions indicated that the claims of the makers are justified.

Sensitivity controls are provided so that the set will perform in normal and overload signal strength areas. Definition, interlace, linearity and other characteristics are up to usual commercial standards.



The Jabel T9 dial and Knob kit shown in the photograph above is available through the normal radio supply houses. Trade price is 10/- plus tax.

TRANSISTOR RADIO SERVICE TECHNIQUES

THE Amalgamated Wireless Valve Co. P./L., of 47 York Street, Sydney, have produced a booklet designed to assist servicemen in handling the transistor radio receivers which they will be called upon to service from now on.

The booklet is actually a reprint of hree articles which have already appeared in their regular publication "Radioronics." The first article is a general ntroduction to the principles of transisors from the point of view of the sericeman, the second and third, general ervicing procedures with some specialisd hints and kinks peculiar to transistor eceivers.

At only 2/ per copy, post free, "Sericing Transistorised Radios" is an excelent painless introduction to the subject.

R TV & H TYPE STEREO RADIO and AUDIO SUB KITS

STEREO

Mullard 2 Stereo chassis box in heavily plated dichromate steel, 40/ plus 25 p.c. S.T. Front plate printed with all graduations, 19/6. Stereo 2, wired and tested. £19/19/ plus 25 p.c. S.T.

R. and H. Low Input Stereo Preamp Box heavily dichromated, 59/6, plus 25 p.c. Tax. Engraved front plate in burnished aluminium with dark red figures, 40/, plus 25 p.c. tax.

R. and H. 10 Watt or 17 Watt Stereo chassis heavily dichromated. 45/, plus 25 p.c. tax.

R. and H. Stereo Radiogram chassis heavily dichromated. 45/, plus 25 p.c. tax.

TEST EQUIPMENT

R. and H. Sweep and Marker Generator case, all chassis printed front panel. £5/18/6. plus 12½ p.c. tax.

R. and H. Wide Band Scope case, all chassis printed front panel. £10/19/6, plus 12½ p.c. tax.

R. and H. Senior VTVM case chassis front panel printed. £4/13/6, plus 12½ p.c. tax.

R. and H. Bench type VTVM case chassis printed front panel. £2/14/, plus 12½ p.c. tax

R. and H. Audio Signal Generator case chassis and printed front panel, £4/13/6, plus 12½ p.c. tax.

R. and H. RC Bridge case chassis and printed front panel. £3/4/6, plus 12½ p.c. tax.

R. and H. Audio Distortion Meter, case, chassis and printed front panel, £3/4/6, plus 12½ p.c. tax.

Any of the above with Engraved front panel, £1/15/ extra.

TEST EQUIPMENT FRONT PANELS

Engraved front panels for any of the above, 50/, plus 12½ p.c. tax; printed, 19/6, plus 12½ p.c. tax.

INSTRUMENT CASES

Finished in grey baked hammerdok.

R. and H. type, MC 5A 9 x 6 7/8 x 5½, 22/6, plus 12½ p.c. tax.

MC 82A, 13 x 8 x 6 7/8, 40/, plus 12½ p.c. tax.

SF 7A 7½ x 7¼ x 7¼ for bench type VTVM, 22/6, plus 12½ p.c. tax.

Cat. No.	Long	High	Deep	Price plus 12½ p.c. tax
MC 6	6	6	6	15/-
MC 7	10	8	7	22/6
MC 67	12	7	6	24/-
MC 81	10	10	8	29/-
MC 811	12	11	8	39/-
MC 79	15	9	7	50/-

SLOPING FRONT CASES

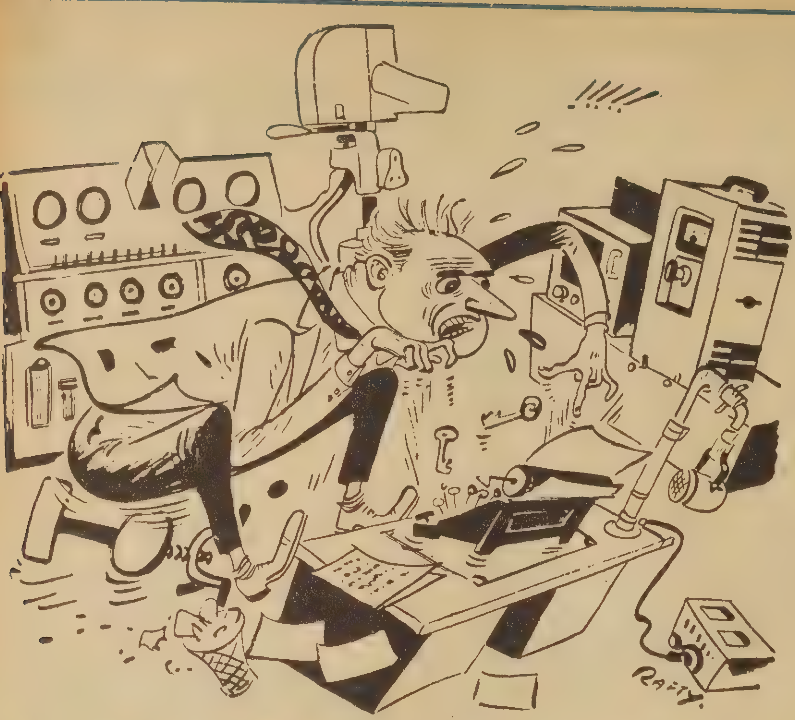
SF 7	7	6½	7¼	22/6
SF 79	9	6½	7¼	27/-
SF 71	11	6½	7¼	32/6
SF 8	13	8	8	39/-
SF 10	18	10	10	50/-

Chassis of 16-gauge Aluminium can be supplied for any of above, all prices plus postage and slightly higher interstate.

MacKinnon and Nicholls Pty. Ltd.,
468 Collins St., Melbourne.
Martin de Launay, Newcastle.
Chandlers Pty. Ltd., Charlotte St., Brisbane.

R. H. Oxford & Son Pty. Ltd.

97 Marriott St., Redfern, Sydney. MX3764.



Let's Buy An Argument

If this article seems to be a little out of character this month, the explanation is not hard to find. It is simply that the seeds of argument and dissent, which I have sown in past weeks, have sprouted to such good purpose that I have been inundated with letters. Three of them occupy most of the available space this month.

by Neville Williams (and others)

FIRST and foremost, the speculation as to the physiological difference between an AC and a DC electric shock has caused many people furiously to think. Two or three of the relevant letters are reproduced herewith, including one which occupies a quite large proportion of the available space.

In addition, I have letters to hand, from readers wanting to argue about stereo systems and about sideband distribution of AM stations, leaving "coloured" TV and service problems still relatively untouched.

A PRACTICAL LIMIT

If I therefore seem to have ignored certain items, please forgive me. There's a practical limit to what can be put into three pages each month.

But before virtually turning the pages over to others, there is one point which I do want to make.

A correspondent, last month, gave his observations on TV insurance and maintenance in London and made considerable point of the fact that premiums would be much higher again than they are, were it not for the fact that his firm, and presumably others, were able to rebuild or repair picture tubes for a fraction of their original cost.

It prompted me to ask, again, why local valve companies will have nothing to do with the idea—as far as I can determine anyway.

Any time that I have raised the question, I've been told flatly that "it isn't economical."

Thumbing through a recent issue of "Radio-Electronics," I came across a double-page full-colour advertising spread for R.C.A. of America. Its message is simple:

If you want the finest tube you can buy (advertisers are seldom very modest) you order a brand new R.C.A. "Silverama" type. It comes to you under the familiar red and black R.C.A. labe is guaranteed to be built from "all ne glass and parts" and carries a warran of 12 months.

Yes, I said 12 months!

But if you want to save money, yo can buy a similar tube, which is a fa tory rebuild by R.C.A.

It comes under a blue and blac R.C.A. label but still carries a fu maker's warranty of 12 months.

Yes, 12 months!

NEW OR REBUILT

R.C.A. tells its dealers that they ar now embarking on "the most informa tive and hard-hitting advertising cam paign ever undertaken in the tube in dustry" directed at selling new OR re built tubes.

It is apparent from other adverts that RCA are not alone in this sale policy.

Which only adds emphasis to my question:

If it is worthwhile in England and the United States to offer fully warranted rebuilt tubes at a lower price to cus tomers who want them, what factor render it "not worthwhile" in Australia

Any time about now, the curve showing the replacement rate for tubes should start to head upwards and a lot of people, with average pockets, would like to know the answer to that question.

But enough of picture tubes, at least for the time being.

As I said earlier, our reference to possible difference between AC and DC shocks has set quite a few people thinking. The most "heroic" effort was by someone who identifies himself as a final year medical student.

Rather than try to intervene as a third party and "interpret" his remarks to readers, the most logical course is simply to quote the letter verbatim, sketches and all. So from here, till further notice, the words are not mine. They belong to G.V.

A READER'S LETTER

Dear Sir,

The AC/DC controversy has interested me enough to try to look up the question in standard physiology texts. I also dug up my practical physiology notes—I am a final year medical student—and the upshot is that I found only a partial answer.

Working from first principles, this is how far I got:

1. Muscle consists of individual cells (muscle fibres). Each cell can give only "all-or-none" response—that is, it either contracts maximally or not at all, quite independent of the strength of the exciting stimulus.

2. The strength of the contraction of the whole muscle can be increased by (a) bringing more muscle fibres to contract (usually only a fraction of the total number contracts at a time), and/or by (b) making the muscle fibres to contract more often.

3. Let's assume that a muscle is stimulated by a single square wave passing through it—a common enough laboratory procedure. (See figure 1.)

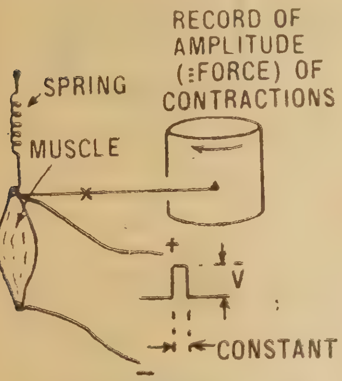


Figure 1

If the duration is kept constant, and the voltage varied, the strength of contractions will increase until a plateau is reached—this occurs when all the muscle fibres are stimulated by the stimulus. (Figure 2.)

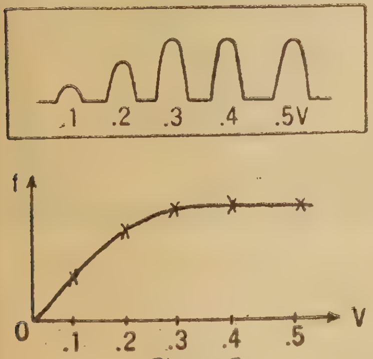


Figure 2

In practical terms, it means that one single brief stimulus will cause a stronger contraction if its voltage is increased —but only until a maximal value is reached.

Another point is that if the voltage of the pulse is kept constant, but the DURATION VARIED, longer pulses will cause a slightly stronger contraction —but only to a point.

This is due to the fact that the stimulus takes a certain time to initiate the contraction, and this time is longer if the stimulus is weaker—so with long pulses some more sluggish fibres are brought into play. Figure 3 shows the essential relationship.

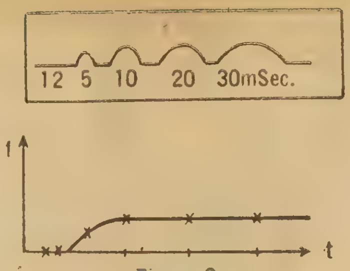


Figure 3

Conversely, shortening the pulse will reduce the strength of contraction, until no response is obtained—no matter what the voltage.

This can be explained in terms of the properties of a single muscle fibre (figure 4).

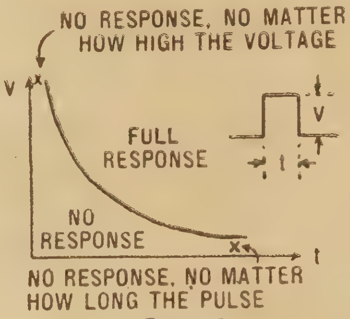


Figure 4

This simple graph may be difficult to grasp, but its essence is that the "effective strength" of a pulse is the product of both its duration and voltage, but that very short or very weak pulses have no effect. It also indicates that a fibre either reacts fully, or not at all.

A still further point—which I want to use later on—is that a RAPIDLY CHANGING voltage is more effective in stimulating muscle fibres than a SLOWLY CHANGING voltage. That is a square wave will be a stronger stimulus than an half-sine wave of equivalent amplitude and duration.

On our muscle-preparation this would cause a greater number of fibres to contract, and thus a stronger contraction results. (See figure 5.)

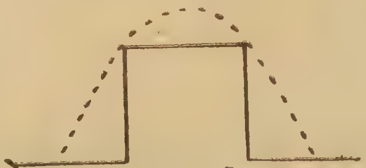


Figure 5

The point is that if the rise is slow enough, no response will occur—notwithstanding how high the voltage, or how long it is applied.

We have considered the response of a whole muscle to a single stimulus.

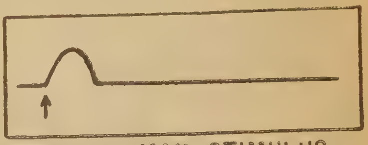
We saw that the effectiveness of the stimulus depended upon (a) voltage, (b) duration, (c) speed of change. And that as the effective strength of the stimulus increases, more and more individual muscle fibres respond, until they all respond, giving a maximal contraction of the muscle.

The stimulus which can produce such a maximal contraction is termed maximal stimulus.

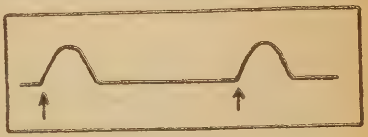
Let us now consider that a muscle preparation is stimulated with A SERIES OF MAXIMAL STIMULI (or, if you like, submaximal stimuli; the argument is essentially the same).

A single maximal stimulus causes a contraction which lasts in the order of 0.1sec.

Maximal stimuli applied at a rate of say two per second will cause contractions essentially similar to the above and illustrated in figure 6.



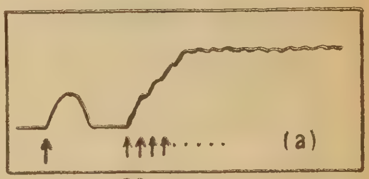
SINGLE MAX. STIMULUS



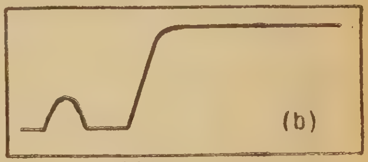
2 per sec.

Figure 6

If the rate of stimuli is lifted to about 20 per second the contractions will summate. The resulting contraction is stronger than the single contraction, but still shows a "ripple" at 20 per second ("partial tetanus"). See figures 7(a) and 7(b).



20 per sec.



60 per sec.

Figure 7

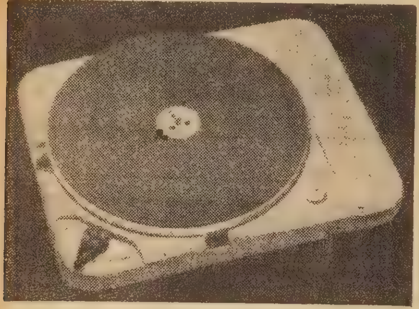
As the rate is raised, contraction becomes still stronger and the ripple becomes less noticeable, until at about 60 per second the contraction is quite smooth and moderate increases of frequency of the stimulation will not increase the strength of contraction any more ("full tetanus").

N.B. Now we have considered effect of varying the frequency of a stimulus, which is itself being kept constant (e.g., maximal). We have seen that the strength of contraction increases with the frequency until about 60 per second is reached, after which it remains constant. See figure 8.

For those who appreciate the difference

NEW "TD" Stereo-Mono TURNTABLES

by THORENS

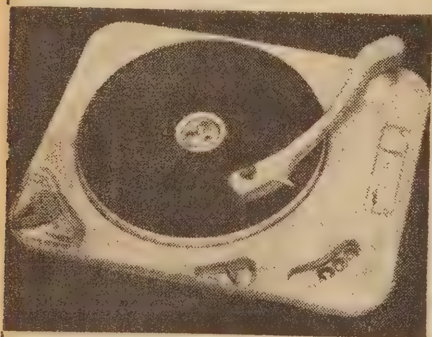


Professional users and discriminating music-lovers will find for the first time so many desirable features harmoniously blended into a new turntable whose basic performance is better than N.A.R.T.B. specifcations for broadcasting studio equipment.

New price as illustrated £61/10/-—With tone arm £70.

Important features include:

- Wooden board for tone arm mounting made integral with the cast aluminium frame.
- Spring suspension of the whole unit on the mounting board.
- Special inbuilt levelling device.
- Inertia-controlled drive system; relatively light, precision built 4 pole motor, associated to a very heavy turntable (11½lb).
- Two steps speed reduction.
- Single control knob for the "On-Off" switch and for the 78, 45, 33-1/3, 16-2/3 r.p.m. speed shift. "Off" positions between each two speeds.
- Variable speed control (plus-minus 3%) acting on the four speeds.
- Precision inbuilt stroboscope for four speeds, 60 and 50 cycles.
- Two parts turntable with clutch action.
- Cast aluminium base plate strongly ribbed.



Model 184L (on left)

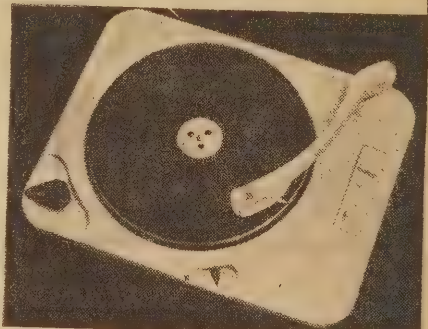
Semi automatic precision player. Designed for stereo operation a single dialling motion selects record size and starts motor, arm literally floats on to record on a cushion of air.

Price £43/10/-.

Model 134L (on right)

Similar unit to above, manual operation with automatic shut off at end of audition.

Price £35/10/-.



Prices as shown DO NOT INCLUDE cartridge. The tone arms feature a plug-in 5-pin shell into which may be mounted the cartridge of your choice. The International standard ½" centre mounting is used.

All units feature the NEW THORENS ultra precise drive mechanism, giving absolute freedom from WOW, FLUTTER and RUMBLE.

UNDOUBTEDLY THE BEST VALUE in Record Playing Equipment Available Today

Also available: GENERAL ELECTRIC stereo and mono pickup cartridges—LEVEL INDICATORS for stereo and mono use.

Make it yourself Kits — For 8" and 12" Loudspeakers — and a versatile Control Cabinet.

CONTACT YOUR DEALER

Fidelity AE

Audio Engineers PTY. LTD.

SYDNEY

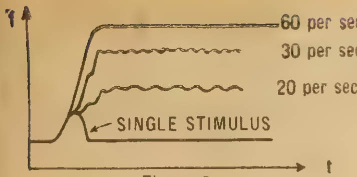


Figure 8

I have tediously put down the basic facts, shorn of any unnecessary complexities (refractory period; concept of motion unit; direct stimulation versus stimulation via the nerve); the fact that it is the current rather than the voltage which stimulates, etc.

As you can see, some—but not all—conclusions can be drawn from them, as far as the effect of the frequency of the stimulus is concerned.

1. HIGH-FREQUENCY CURRENTS (say, to be on the safe side, 100 Kc). No effective stimulus; individual stimuli are too brief to stimulate. (Also possibly the effect of the refractive period of the muscle—I have not discussed it.)

It is well known that RF cooks you without any other sensation at the time but gentle warmth.

2. CURRENTS IN THE 50-60 CYCLE RANGE: Maximum contraction. Best frequency to cause a full constant muscular spasm ("full tetanus")!

3. CURRENTS IN 0-60 CYCLE RANGE: Every cycle causes one (I think) contraction. The strength of the main contraction is approximately proportional to the frequency. Spasm produced is not steady.

4. DC. This is a curly one. A rapid rise of current should cause only one contraction and a slow rise not at all. A perfectly steady current should allow the muscle to relax.

But is the current, as far as the individual muscle fibres are concerned, steady?

Minor variations at the electrodes will change the current.

And if some fibres contract (or relax) they will alter the physical configuration of the muscle, and thus the path of the current through it, therefore altering the current through some of the fibres, which will thus be stimulated and contract, and thus alter the physical configurations . . . So one would actually expect an irregular submaximal twitching of the muscle.

I sympathise with the medical practitioners to whom you put this question!

Yours faithfully, G.V.

IN CONCLUSION

Well thank you G.V. and also to our other correspondents whose letters appear on this page. Having regard to the bulk of these contributions, it was only the decent thing to add "and others" to the By-line on page 96.

Finally, I have a note from Mr H. Bratspies, of Mental Hospital, Mont Park, Melbourne. Possibly prompted by the forgoing subject matter, he advises that a Medical and Biological Electronics Society has recently been formed in that city.

He invites enquiries from readers who may be interested in joining same.

ELECTRIC SHOCK — OTHER IDEAS

Dear Sir,

I have been following your argument on the merits of the holding effect of AC and DC.

I recall the last article on the subject and was very surprised to find that not one but two learned doctors could not answer the question.

The solution lies in the effect on the master nerves of the system.

DC is complete paralysis of nerves, whilst AC does not completely paralyse the nerves: it merely contracts and expands the nerves in the system.

DC also ruins the ends of the nerves.

AC does not, but will burn the area which is exposed to the conductor as will DC.

For example place the body on an insulated base without earth contact.

Charge with 1,000 volts AC and the body does not undergo any change.

Do the same to a body with the source of DC. The body almost at once becomes paralysed.

The fallacy that DC will hold on less is not therefore right as stated before, because of complete paralysis.

Any body that has been properly electrocuted will not let go even on death, owing to the contraction of muscles.

The reason for a person getting flung off AC or DC is purely because the contact with power lines has been made with some part of the body which has not had a chance to contract such as a finger tip, the side or back of the head or the lower part of the body trunk.

"Or," I quote, "insufficient contact with the voltage required to be fatal."

Yours sincerely, R.W.

* * *

Dear Sir,

The subject of electric shocks has always interested me so I have made a point over the years of collecting bits of information from which to construct a picture of its mechanism. The most important concept is that associated with the type of signal handled by the nervous system.

This signal is of a pulsed form, the frequency amplitude and pulse lengths varying with the information being carried. Thus the signals received by muscles from their connecting nerves are not unidirectional in nature but are effectively alternating.

It is obvious that any signal of a pulsed or alternating form that is applied to a muscle is capable of causing a reaction of the same type as that caused by signal from the nerves, i.e. the muscle so stimulated contracts in proportion to the strength of the signal.

Contact with a source of direct current constitutes just such a pulse. The breaking of contact is a second pulse. In each case a momentary muscular contraction occurs followed by a relatively slow relaxation.

Contact with a source of alternating current causes a sustained contraction of all muscles affected just as if the muscles were receiving impulses from the brain via the nervous system.

The pattern of behaviour in the case of a severe shock is almost completely uniform among human beings. Since all muscles contract, those that are strongest overcome the weaker ones.

As your correspondent A.G.M. pointed out, the arms tend to be drawn in towards the body and the hands are clenched. These are the strongest muscles in that part of the body. The throwing effect is generally caused by the legs suddenly stretching out to their maximum as the muscles that bend or lift the foot are relatively weak.

In this manner it is possible for anyone to determine his own reactions to electric shock for any part of the body by testing which of his two opposing sets of muscles is the stronger.

Of course, the path of the current may be such that selected muscles are stimulated. In that case prediction is not possible and this appears to be the case with A.G.M. in the case of his legs which bent rather than stretched.

An interesting test which may be carried out using an audio oscillator is to apply two metal plates moistened with salt solution to a muscle, say that at the base of the thumb. Set the oscillator output voltage to around 15V and connect it to the two plates. By varying the frequency of the oscillator it will be found that the muscle may be made to contract quite strongly and that the greatest contraction occurs at 3,000 c.p.s.

This is known as the "physiological frequency." (Radio-Electronic, 27. 53, 1956). Only a slight tingling will be felt.

This appears to cast doubts on the I.E.E. frequencies of 20-200 c.p.s as 15 volts in that range cannot be detected except with the tongue. Perhaps that range is the worst in its effect on the brain. There is no doubt that 3,000 c.p.s. is the most difficult to let go.

Keep up the good work on your most consistent magazine.

Yours faithfully,
R. L. Thompson.

STABILITY . . . 180v. — 260v.

"PAYNECO"

ZERO WAVEFORM DISTORTION

SERVOMEX A.C.2. M.K.IIB

	AC 2	AC 7
RATING	0 to 9 amps	0 to 30 amps
RANGE	—17.5% to + 8.75%	— 20% to + 10%
RESPONSE	15 volts per sec.	12 volts per sec.

ACCURACY 0.25%.

TRUE RMS. STABILISATION.

EFFICIENCY 95% OR BETTER.

ZERO DISTORTION.

RUGGEDISED CONSTRUCTION.

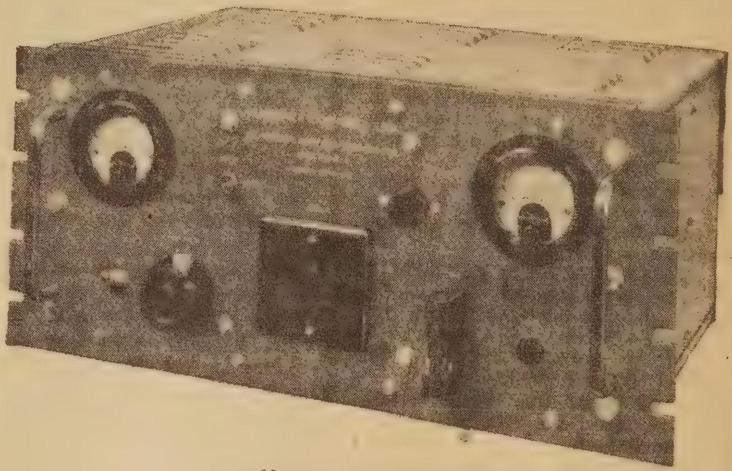
UNAFFECTED BY FREQUENCY CHANGES 45c/s-65c/s

NO RELAYS, THYRATRONS OR ELECTROLYTICS.

LOAD POWER FACTORS TO UNITY LEAD OR LAG.

V & I METERING VOLTMETER SWITCHES TO INPUT OR OUTPUT.

FRONT PANEL CONTROL ENABLES USE AS VARIABLE SUPPLY.



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This depends on the builders . . . and you know what builders are! It looks as though we'll be open for business about 15th October, but if you're making a special trip, why not ring FU 9197 beforehand, just to make sure?

HI-FI COMPETITION

There is still just time to win a stereo amplifier, valued at £52/10/-, and many other prizes, including speakers and pick-ups, as announced in last month's edition. Rules:— Simply write an essay in 100 to 400 words entitled "Stereo and Hi-Fi . . . are they really worth it?" and mail your entry to arrive, not later than 15th October, at ***Hi-Fi Competition, Box 1976, G.P.O., Sydney.*** *Entries will be judged by Mr. Ken Page, Secretary, Audio Society of Australia, and results published in this magazine.*

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OFF THE RECORD — NEWS & REVIEWS

Every now and then we hear from a reader who takes us to task because he thinks we do not say enough about the advantages of tape for playback. Occasionally we are even charged with misleading our readers about the alleged superiority of discs, the assumption, apparently, being that we discount tape by not talking much about it.

by John Moyle

Such letters puzzle me at times, but hey also inspire me to talk back a little o make clear a position which I feel ias been misconstrued.

We have never at any time said or mplied that the quality to be obtained from first class tape and tape playing equipment is not superior to that from iscs.

I would have thought the case for tape on quality grounds would have been self-evident.

It is self evident because a moment's thought will remind us that all recordings made today were originally taken down on tape, and played back through tape equipment to feed the disc cutting head.

FEWER PROCESSES

I don't think there can be any argument, therefore, that to take such sound directly from the playback machine, and feed it through an amplifying system, would involve the fewest possible transfer processes, and would therefore give better sound.

As soon as we hook up the cutting amplifiers, feed the cutting head and energise the stylus, engrave the disc and subject it to a standard process of processing down to the final product, and then start all over again with a pick-up and further amplification, we commence a degradation of the initial sound and a progressive addition of distortions, all of which can only make the final sound of poorer quality, no matter how successful we are in keeping this degradation within limits.

We cannot therefore consider the merits or demerits of tape and discs without remembering the cost and convenience of supplying the end result.

A really good stereo tape deck, comparable with that used in making recordings, is a very expensive thing, and not available to everybody. It implies special amplifiers, complete with bias oscillators and the like, adding still further to the cost and complicating the circuitry.

TAPE COPIES

And after all this the operator has to buy copies of stereo tapes (or mono types for that matter) and, we hope, in the same variety and quality as are available on discs.

Now this just can't be done at the present time except by keen types who will go to no end of trouble and expense to hunt them out.

I think it fair to point out that stereo tapes were plugged for some years before stereo discs came to light, but their success was almost a negative quantity as against the number of discs which have been sold since the new disc era.

If the tapes were in fact a better proposition than discs, I imagine the story would have been different.

It's not therefore a case of whether tape is better than disc. On a first-class quality basis it is, but when we think of public consumption, it just hasn't reached first base.

And frankly I don't think it will for as far ahead as we can see.

Now in producing a magazine, we are best serving the vast majority of readers by concentrating on equipment and techniques which will show them how to get the best results from discs, the medium which they, the public, have already decided they want to use.

There is no implication in this that we think tape is not as good as disc for quality, or even that we have any ideas about tape at all, one way or another.

Equipment for tape decks isn't as easy to develop as all that. I don't mean that electrically it has problems which we haven't tackled quite successfully in the past and could tackle equally well today.

But mechanically there are so many different kinds of decks that it would be probably impracticable to emerge with a single design to suit them all.

There is more to tape decks than just a recording head and a capstan. There are types with a different number of motors, different ideas about switching and so forth which make matters quite difficult.

And our readers these days don't like having numerous loose ends which they have to tidy up themselves.

So please, if you have any ideas that we don't like the results from tape, forget it. But if you have the idea that we think the disc is more convenient, and that we should do all we can to help people use it to better advantage, you are dead right.

HIGH STANDARD

On the credit side, the tape enthusiasts should not overlook the fact that modern discs of all types are reaching an amazingly high standard.

It could be that, in the long run, many people would be hard put to tell the difference between a good disc and its tape original.

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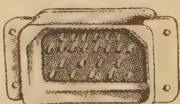
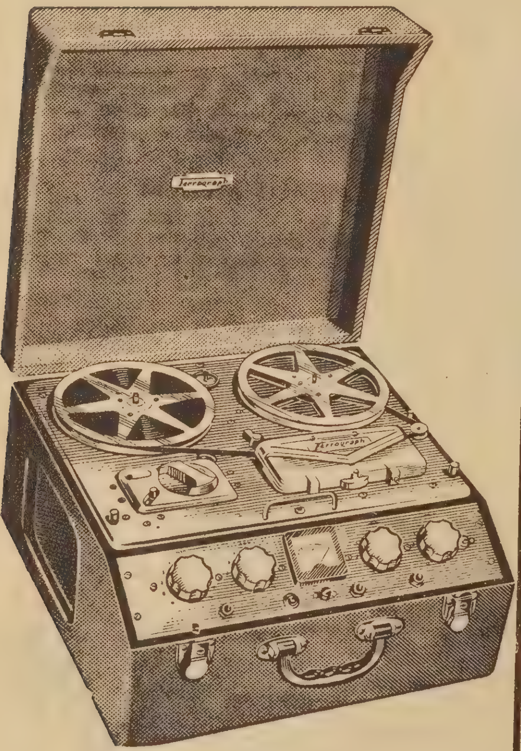


8 IMPORTANT DESIGN IMPROVEMENTS IN NEW FERROGRAPH SERIES 4



This latest development of the incomparable Ferrograph incorporates several new design improvements and will enable every Series 4 Ferrograph to be readily adapted at any future time for a variety of applications. For example, space has been provided under the Head Cover to permit Head changes and additions for monitoring, stereo recording, stereo playback, dual track stereo to the new American standard or for lower track use. Such heads are designed to be plugged in and are fitted with rocking facilities for azimuth correction.

Also, this new development permits any Series 4A to be instantly converted to a Series 4S merely by plugging in the additional stereo head.

Other important design improvements are:

- The capstan motor is resiliently mounted for quiet operation.
- Function Switch Knob is re-fashioned for greater ease of operation.
- Brief Stop is now a standard fitting on all Ferrographs.
- The Head Cover—a one-piece moulding—is hinged for easy tape loading.
- The Turns Counter—now gear driven—is accurate to a turn.
- New standard colour scheme for all models—2-tone grey.

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PLEASE WRITE TO US FOR FULL DESCRIPTIVE LITERATURE AND NAME OF YOUR NEAREST DISTRIBUTOR AND SERVICE AGENT

There is in most things an optimum standard beyond which it is hard to persuade most people to advance if it costs them time and energy and extra complication to do so. Many a good idea has fallen by the wayside just because of the sales resistance to some feature which on paper looked to be quite trivial.

Even the latest tape cartridges which are being publicised with millions of dollars overseas are having a hard battle to forge ahead.

For in chasing the convenience and easy handling and storage of discs, standards have been lowered so that the initial advantage of high quality which tapes enjoyed has been degraded in some instances below that of the comparable discs.

I think the opinion frequently expressed that the day of the record is numbered, and that the stereo disc is the dying kick of an outdated medium, could be just a pious hope.

The statistics just don't support the idea.

* * *

THE SPIRIT OF PAGEANTRY —Spirit of Pageantry March, Ceremonial March from Aida, Lustpiel Overture, Wee MacGregor, Light Cavalry, The Windjammer, Hielan' Laddie. Played by the Band of the Grenadier Guards. Decca SKLA 4028 (Stereo).

Stereo has worked wonders for the military band, as demonstrated here.

Despite the ingenuity of technicians, no one has succeeded in making a band sound really convincing in mono, for in striving to build realism by one device it has been robbed in another.

The difficulty has been, as with other combinations, that microphone placement was the only way to highlight an instrument or an effect.

A constant procession of instruments approaching and retiring from the microphone wasn't the answer, no matter how well the ear served us by filling in.

But here there is no such limitation.

The sudden opening out of the sound front has transformed the band into something you have never heard before.

It is quite miraculous to note how the ear separates the euphoniums from the trombones, from the trumpets, from the cornets and so on, quite effortlessly, and with a sense of rightness which all too soon slips into the normal way of things.

But just switch to mono and note the difference.

This again is the true use of stereo. There is virtually no separation as such, rather is there a bias in one direction or another, and a most extraordinary sense of depth. There is one spot where I could almost tell you how many rows back the trombones were sitting.

You should play this one at pretty full volume unless you want to hear a rather anaemic band.

Give it the herbs in Light Cavalry, or the Windjammer, and you'll get as big a thrill as a band ever gave you.

The Grenadiers is not a super brilliant combination — I have heard Aida's trumpets ring out much more triumphantly—but it is a wonderfully steady and solid band.

Here its tone is round and full, and often really wonderful.

Mind you, you have to like band music.

But there is pageantry in this one, and that's what it says on the label

POP GOES THE CONCERT— Thirteen arrangements of classical tunes for piano and rhythm accompaniment. Played by Skitch Henderson and his Orchette. RCA SL10573 (Stereo).

Whatever you think of Skitch's treatment of tunes from the classics you'll have to admit he has received some exceptionally realistic recording.

His cohorts in crime include drums, string bass, electronic guitars, bells and so forth, but Skitch is the star performer.

They support him well whether the pace is fast or slow, and they are practised hands at this kind of thing.

If your separation is good you'll probably note that the piano shifts its ground slightly from one number to another, and from the content of the music I'd say that was intended.

With the exception of a few places where the piano seems to take on a slight fuzziness, its tone is very realistic.

The bass is particularly round and full, and some of the lightly struck notes are startlingly realistic.

The surface is a very good one, being for the most part inaudible.

* * *

BROADWAY IN RHYTHM — Selections from Oklahoma, The King and I, My Fair Lady and South Pacific. Played by Ray Conniff and his Orchestra and Chorus. Coronet KLPS 743 (Stereo).

This is very effective, big band stuff, broad and airy in its recording, and lavish in its effects.

Key instruments are highlighted and positioned from time to time. They bob up in one or other of the speakers with a complete disregard for geography. But no one should worry about that when the results are as good as "I Could Have Danced All Night," for instance.

The steady plucked bass background is about the only thing that stays put for very long.

To add to the spread and glamour, a chorus makes noises to help the tune along without any actual words being heard or necessary.

This is music virtually written and engineered for stereo—the new system is used to create effects which have no necessary connection with what is or is not possible in life.

But give yourself a good sized room, a bit of extra volume, and you have a splendid example of hi-fi stereo with all the stops out.

The surface is completely silent even in quiet passages—when you can find them — and the general quality very clean.

Two minor criticisms—a slight tape hiss and a slight tape hum. Neither are enough to worry you, but don't go looking for them elsewhere.

* * *

SOUND IDEAS—Les and Larry Elgart with orchestra in 12 numbers. Larry Elgart on the Alto Saxophone. KLPS 691 (Stereo).

This is one of Coronet's first releases, and it's a honey of its kind.

You don't have to be a jive expert to appreciate its good points.

Or, its intriguing and fascinating arrangements, or its orchestration, brilliant by any standards, or its variety in style which somehow still remains the same, or the excellence and precision of its soloists

(Continued on Page 107)

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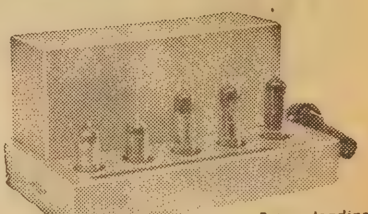

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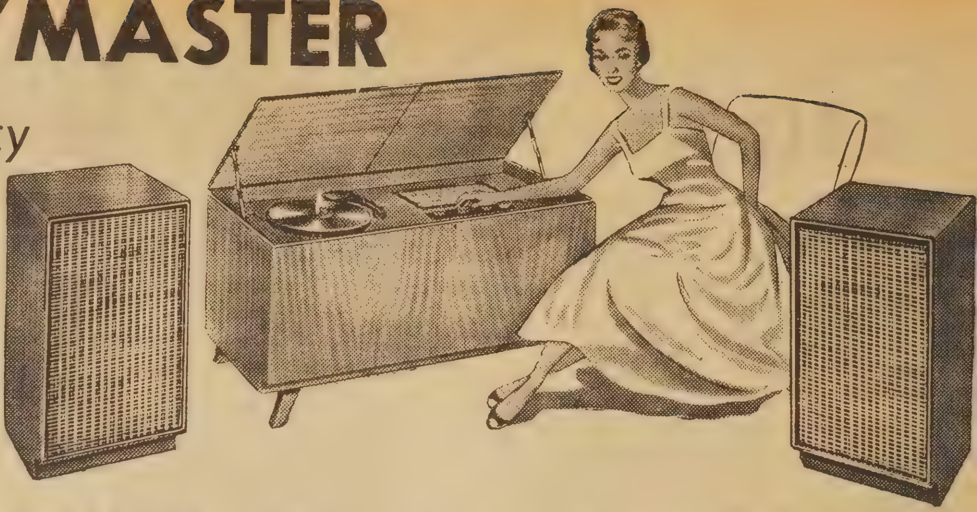

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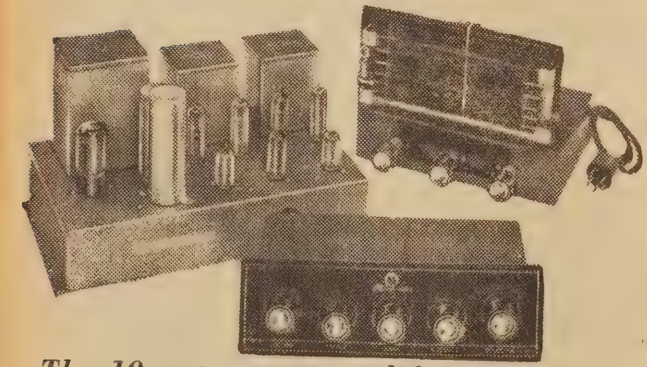

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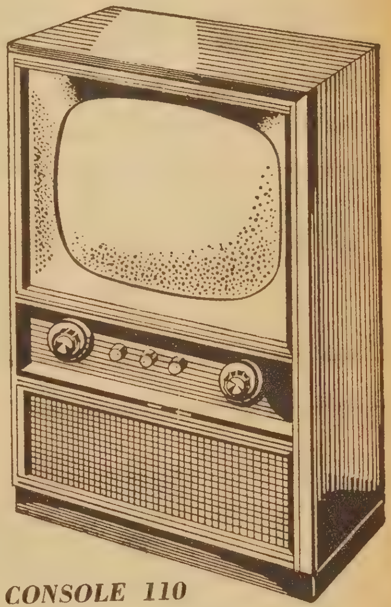

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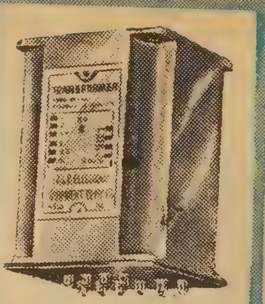

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See Valve Chart	Type OT	Watts Rating	Primary Impedance (Ohms)	Secondary Impedance (ohms)
A	928A	5	7,000, 5,000 S.E	15, 8, 3.7, 2
B	932	7	10,000 P.P.	15, 12.5, 8, 3.7, 2
C	929	10	4,000, 2,500 S.E.	15, 12.5, 8, 3.7, 2
C	930	10	4,000, 2,500 S.E.	500, 250, 125
—	809	15	500 (line)	15, 12.5, 8, 3.7, 2
D	914	15	5,000, 3.000 P.P.	500, 250, 166, 125, 100
D	915	15	5,000, 3,000 P.P.	15, 12.5, 8, 3.7, 2
E	917	15	10.000, 8,000 P.P.	500, 250, 166, 125, 100
E	918	15	10,000, 8,000 P.P.	15, 12.5, 8, 3.7, 2
F	922	25	8,000 P.P.	500, 250, 166, 125, 100
F	891	35	6,600 P.P.	500, 250, 166, 125, 100, 83
G	892	55	3,200 P.P.	500, 250, 125, 83, 62, 50

HIGH FIDELITY

See Valve Chart	Type OT	Watts Rating	Primary Impedance (Ohms)	Secondary Impedance (ohms)
P	2558	3	10.000 S.E.	15, 8, 3.7, 2
	933	3	5,000 S.E.	15, 8, 3.7, 2
H	870	6	10.000 P.P.	2 or 8
	2525-8	10	8,000 P.P.	2 or 8
	2525-15	10	8.000 P.P.	3.7 or 15
J	871	12	10.000 P.P.	2 or 8
J	872	12	10.000 P.P.	3.7 or 15
D	763	15	5.000, 3,000 P.P.	15, 12.5, 8, 3.7, 2
E	896	15	10,000, 8.000 P.P.	15, 12.5, 8, 3.7, 2
E	897	15	10.000, 8.000 P.P.	500, 250, 166, 125, 100
D	920	15	5,000, 3.000 P.P.	500, 250, 166, 125, 100

HIGH FIDELITY—*Ultra Linear*

Screen Taps 19% of Plate Impedance—43% Turns.

See Valve Chart	Type OT	Watts Rating	Primary Impedance (Ohms)	Secondary Impedance (ohms)
K	949	12	8,000 P.P.	15, 12.5, 8, 3.7, 2
L	916-8	12	8,500 P.P.	2 or 8
L	916-15	12	8,500 P.P.	3.7 or 15
M	921-8	20	6,600 P.P.	2 or 8
M	921-15	20	6,600 P.P.	3.7 or 15
N	931-8	20	4,500 P.P.	2 or 8
N	931-15	20	4,500 P.P.	3.7 or 15

HIGH FIDELITY—*Ultra Linear*

Screen Taps 19% of Plate Impedance—43% Turns.

† ON GRAIN-ORIENTED CORES

	Type OT	Watts Rating	Primary Impedance (Ohms)	Secondary Impedance (ohms)
Q†	4005	7	9,000 P.P. (U.L. Taps 20% Turns)	3.75, 7.5, 15
	2540-8	10	8.000 P.P.	2 or 8
	2540-15	10	8.000 P.P.	3.7 or 15
†	4000-8	10	8.000 P.P.	2 or 8
†	4000-15	10	8.000 P.P.	3.7 or 15
†	4001-8	20	6.600 P.P.	2 or 8
†	4001-15	20	6,600 P.P.	3.7 or 15

VALVE CHART

FOR USE WITH VALVE TYPES

A: 6V6's, 6BW6's. KT61's. 6M5's, EL84's. etc.
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C: KT66's. 6L6's, 807's, EL37's, etc.
D: 2A3's, 6A3's, 6AS7G's, etc., in Class A or AB1.
E: 6V6GT's. 6BW6's. 6M5's. KT66's, etc., in Class A or AB1.
F: 6L6G's, 807's, KT66's, in Class AB1.
G: 6L6G's, 807's, EL34's, EL37's, in Class AB2.

FOR USE WITH VALVE TYPES

H: 6V6GT's. 6BW6's, 807's as Triodes in Class A.
J: 6L6G's. 807's, KT66's, etc., in Class A.
K: 6V6's. 6BW6's, KT61's, EL84's. etc.
L: 6V6's, 6BW6's, KT61's, etc.
M: 807's, KT66's, EL34's, etc.
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OFF THE RECORD — Continued from page 103

These fellows have a clear idea of the kind of sound they want, they have worked it out, and it makes sense to me.

The stereo engineering makes sense, too, for it is superb.

It's closely miked; so well does it hit the optimum that the impression is the instruments are there.

I have rarely heard a similar disc with such a fine sense of presence.

And what that separation does to the contrasts and balance is nobody's business.

I don't mean that it's all one side or the other. The separation is only part of the realism, and a necessary part.

The rest of it fills in the middle, and round about the middle, with solid sound.

I should imagine that in a small hall, playing this disc wouldn't show difference between it and the real thing, except that possibly the record would have the richer sound.

If you are looking for a demonstration disc of this type, you just couldn't go wrong.

* * *

RAVEL — Bolero, Ma Mere L'Oye; CHABRIER — Bouree Fantasque. Played by the Detroit Symphony Orchestra conducted by Paul Paray. Mercury SR90005 (Stereo).

This is far and away the best recording of Bolero I have ever played, and the reason for it is stereo.

I first heard this piece when it was first performed in Melbourne many years ago, and to my unpractised ears it was a terrific experience, as they say on TV.

Bit by bit its glamour faded, and in recent years I joined the army of reviewers who groaned to themselves every time a record came along featuring it.

But stereo has changed all that, for it has given back to Bolero the main source of interest, the placement of instruments.

It begins, you will remember, with a catchy little tune taken up by various instruments with each repetition, until the whole orchestra voices it, to fall apart in the last few bars as though the dancer, who is supposed to match its tempo with ever quickening pace, falls exhausted.

And through it all, the snare drums beat out the rhythm which never alters. Only the volume slowly increases with growing colour and some simple changes of key, making what is really a masterpiece of its own, one of those things with an idea and unswerving consummation of it which fits immediately into a niche which now seems to be permanent.

The main point of interest, as these instruments gradually add themselves up into a full orchestra is their positioning, as much as their contribution to the growing torrent of sound.

This is now possible with stereo, and believe me it's there in a way you wouldn't have believed possible.

Once again I made my favourite check by switching over to parallel channels, and the loss was unmistakable.

Full marks for this. The playing is first rate, the recording does full justice to the whole idea, there is excellent range, including a beautiful bass, and the steadiness of the crescendo most admirably done.

If you think you have had Bolero—you haven't.

The Chabrier, originally piano music, was arranged for orchestra by Felix Motti, and although it bears the mark of the period, it isn't hard to see why the composer fell short of the genius of Ravel and Debussy.

I have little but praise for the performance and the recording; it makes an interesting foil to Bolero and altogether I thought the record made a very good buy.

The engineering is excellent, and the surface, although not perfect, is better than average.

* * *

MOZART—Sonata No. 15 in C major (K545); Fantasia in D minor (K397); Rondo alla Turca from sonata No. 11 in A major (K331): played by Julius Katchen. Decca CEP 528.

This is a gem of a disc, and I am sure you will find it irresistible.

The high powered Katchen has tamed and tempered his quality in a beautiful performance of the sonata, clearly articulated, faultlessly phrased, delicately and yet firmly shaped.

Its simplicity is capitalised almost into a miniature, which in many ways it is. There are no affectations to spoil its style, or exaggerations to break the inevitable and perfect line of its melody and clean architecture.

The Fantasia which won't be so familiar has an unusual atmosphere more akin to Beethoven than to Mozart in many places, although its final phases are easier to place.

The Turkish Rondo gives the pianist more scope for his brilliance but there are spots here where his attack has prejudiced piano tone, more noticeable because the remainder is so very good. And Decca has produced some better surfaces.

I listened with complete delight to these beguiling and masterly performances.

* * *

BAYREUTH FESTIVAL — Operatic choruses from the Flying Dutchman, Tannhauser, Lohengrin, The Mastersingers, Twilight of the Gods and Parsifal. Sung by the Festival Choir with the Festival Orchestra conducted by Wilhelm Pitz. DGG LPEM 19168.

The main feature of this disc is the authenticity of the singing, which is quite unlike that of the concert versions heard so freely, and mostly on records.

This is only to be expected, for the performers spend their lives singing for the stage, and that is exactly the impression we gain here.

The recording, too, illustrates all the advantages and disadvantages of being made in a theatre, for that is the quality of the sound. The implication is that it was made in the Bayreuth theatre.

The first side contains some of the finest choral singing I have ever heard.

It has that Germanic character so completely removed from the plated versions offered by choruses of other origins which sing, often impeccably, but with no true style.

The Festival choir not only has a superb technique and faultless attack but its ensemble is quite outstanding. The voices blend as only a balanced combination can, and they make new things of even the oldest soldiers.

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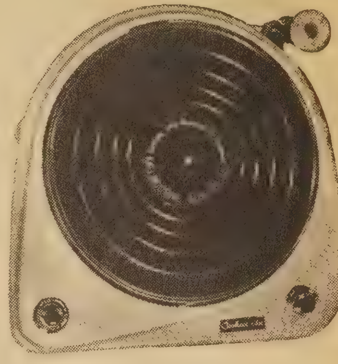

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The most ambitious item, the Hagen horus, seemed less successful than the thers, partly because the acoustics eemed to be against it. More reverberation is needed where the impact of isual performance is lacking, but if the ound is rather dead the drama is there. osef Greindl makes up in atmosphere hat he might lack as a microphone rtist.

There are rather long silences between tems, which help in spotting them inividually but accentuate the disconinuity inevitable with a collection of his kind.

Excellent on-the-spot recordings and inging of the highest grade.

* * *

BEETHOVEN—Symphony No 7 in A major Opus 92. Played by the Philharmonia Orchestra conducted by Guido Cantelli. HMV ALP 1472.

I think this is one of the best recordings of the Seventh. In many ways t is the best.

Its weakness, and all versions I have heard fall short of the ideal, is that it is not consistently as good as it should have been.

I liked it because it has, above all, a sense of style, convincing and appropriate. Particularly in the first two movements, I found myself making approving noises many times over passages played the way Beethoven should be played.

It is not stylised playing; I do not feel Cantelli is being over-interested in any part of it, as so many other conductors are. He has no favourite bits, nor does he serve it up as though anxious that you shall not miss this effect or that phrase.

In fact he often goes too far in this, although the failure to capitalise on a necessary dynamic, or to develop fully an important phrase, may have been due to the recording rather than the playing.

I have seen such things happen many times in a recording studio, where the microphone does not register the effect which has been obvious in the studio, and which is corrected by a second and often a third run-through with an altered placement or a different degree of mixing.

Or it could have been due to the reluctance of the conductor to edit his work as carefully as he should have done, for Cantelli was a heartbreak to engineers, and was just as likely to storm out of the place over some quite trivial matter.

He has been known to abandon a session almost before it started because some outside noise annoyed him, or a distracting movement upset his mood.

In the last movement these things are most noticeable. One can almost sense concentration lagging as the symphony progresses.

A comparison with Klemperer will reveal this contrast in finish. Although the older man sounds almost laboured at times by contrast, you won't find many bars which sound as though they should have been done over again.

Nor is the sound as well defined as Klemperer's. Cantelli's balance obscures some parts which should be heard when the full orchestra is at work.

Nevertheless it is a fine record, and if it brings no new thoughts to the symphony it treats it musically with integrity and distinction.

The surface is excellent.

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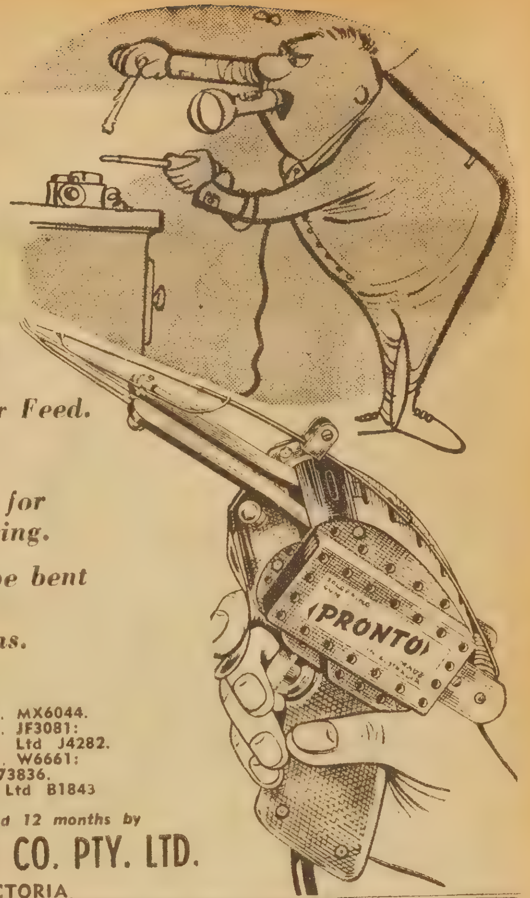

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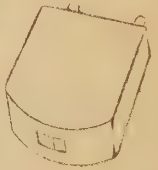

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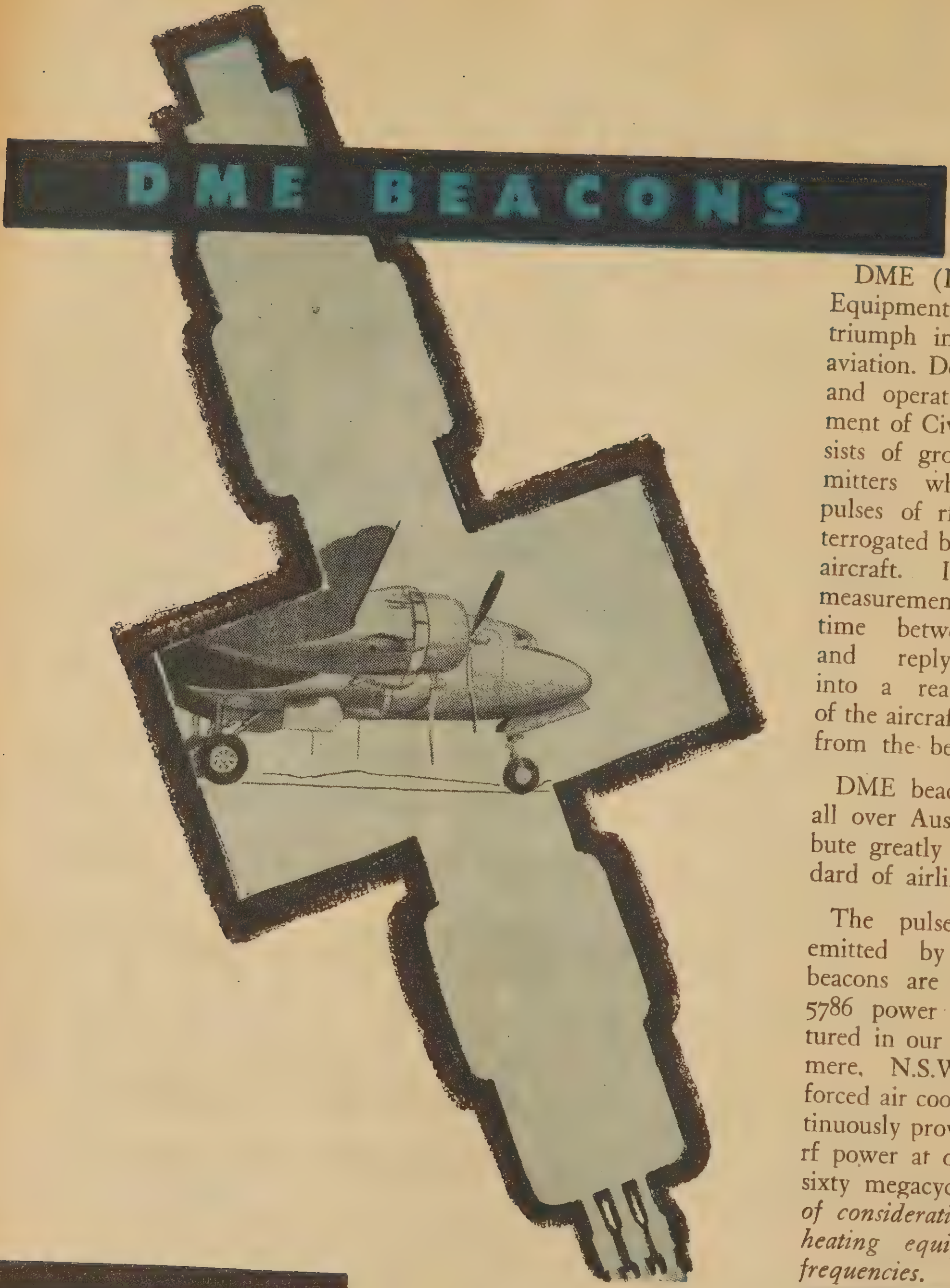

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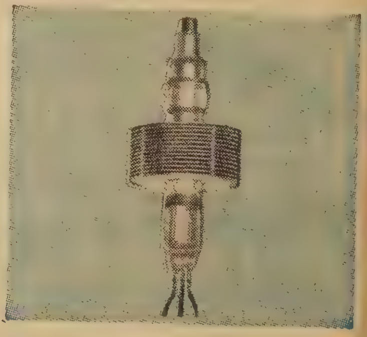

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TECHNICAL BOOK REVIEW

ELECTRONIC HANDBOOK

ELECTRONIC ENGINEER'S EFERENCE BOOK, Second Edition nder the general editorship of L. E. C. ughes and published by Heywood and ompany Ltd., London. Hard cover, 588 pages, 7½in by 5in. Illustrated by rcuits, graphs and line drawings.

No one reference book can hope to olve every problem for every electronic ngineer. However, here is an authoritative work which can take its place, longside those edited by Terman in the nited States and Langford-Smith in ustralia, on the desk of every technical ectronics man.

The background of the book is British. r Hughes is a member of the British nstitution of Electrical Engineers and as held a number of high academic and ndustrial posts in England. He is assistd by approximately 75 specialist conributors, nearly all with senior academic ualifications.

For reasons of space and because they ave been adequately covered elsewhere, radio and television, radar and elecommunication are omitted from this andbook. This does not mean that the ook will not be of value to engineers vorking in these fields. Emphasis is on undamentals which could as well be abelled physics, chemistry, metallurgy, nathematics, etc., as electronic engineerng, and therefore of as much value to he practising radio engineer as to the utomatic control engineer.

Knowledge on the subjects treated is p to date with the second edition pubished in 1959. Rocket technology, nucear power, etc., are covered from the oint of view of the modern electronic ngineer.

Dewy Decimal classifications tend to ecome cumbersome in this field. Therefore the authors have adopted a reference ystem which divides the subject into ine broad fields. These are further ubdivided into nine sections and these again into nine articles with a possibility of up to nine paragraphs per article. A number with up to four figures is used o locate a topic both in the table of contents and the index. The system is ogical and after a little practice becomes easy to use.

The nine general classifications in the ook are "Fundamentals," "Radiations," 'Electrics," "Valves," "Materials," 'Vibrations," "Computing," "Automatics" and "Miscellaneous." Taking "Vibrations" as an example, this is divided into "Ultrasonics," "Vibration Therapy," "Sound Radiation," "Acoustic Measurements" and "Electronic Music." Each of this last series of topics is further subdivided into up to nine parts. "Electronic Music," for example, embraces "Musical Scales," "British Standard Concert Pitch," "Tuning a Keyboard," "Electrophonic Organs" and the "Composertron.'

References to the subject under discussion are placed at the end of the paragraph rather than at the end of the chapter. They are numerous and gathered from both sides of the Atlantic.

Paper, printing, diagrams and binding of the book are of a quality appropriate to a reference book which will be used often over a period of many years.

The Australian price is 121/ plus packing and postage. The review copy by courtesy of the Technical Book and Magazine Co., 295 Swanston Street, Melbourne (M.V.F.).

NON-TECHNICAL Hi-Fi

FUNDAMENTALS OF HIGH FIDELITY, by H. Burstein, published by John F. Rider Inc., New York. Soft cover, 136 pages, 8½in by 5in. Illustrated by numerous photographs, circuits, graphs and line drawings.

Most books on high fidelity approach the subject from the equipment angle. Only one chapter in this book is devoted to the description of the components of a high fidelity sound system, the remainder being concerned with spelling out the attributes of high fidelity performance which distinguish it from ordinary radio gramophone systems.

Even if you never intend to do any construction of equipment, it is necessary to absorb a few technical terms in order that the purchase of new equipment or additions to your present equipment can be discussed intelligently with the salesman. Basic information is presented in this book without the jargon which makes so many excellent books difficult for the non-technical reader.

The main pre-requisite for an enjoyment of this book is an appreciation of the results of a high quality sound system.

Individual chapters are labelled, "Contents of a High-Fidelity System," "The Meaning and Significance of the Decibel," "Frequency Response, Distortion and Noise," "The Original Sound and the Playback System," "Programme Sources and the Listener," "Matching High-Fidelity Components," "Loudness Compensation," "Equalisation" and "Impedance."

The Australian price is 31/ plus 1/ postage. Our copy from the Technical Book and Magazine Co., 295 Swanston Street, Melbourne.

THE MORSE CODE

MASTERING THE MORSE CODE, by Martin Schwartz, published by the American Electronics Co. Soft cover, 32 pages, 9in by 6in.

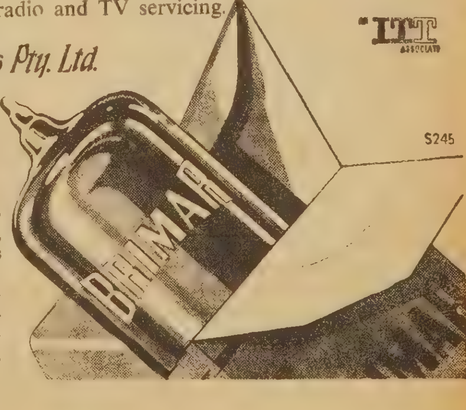
A useful and inexpensive booklet for people who would like to learn the code and qualify for the unrestricted amateur operator's certificate of proficiency or other examinations.

An introductory chapter explains advantages of code transmissions when atmospheric or man-made interference renders communication difficult. Code transmitters require less power and are lighter and less costly than voice transmitters.

Later chapters give rules for mastering both code reception and transmission. Practice groups are included in the text.

An appendix describes a code practice oscillator designed for operation from 110-volt mains either A.C. or D.C. It is not suitable for local conditions and in any case is superseded by transistor practice oscillators.

Our copy from the Technical Book and Magazine Co., 295 Swanston Street, Melbourne. The price is 6/6 plus 9d postage. (M.V.F.)



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S245

SHORT-WAVE NOTES BY ART CUSHEN

LOW POWERED CANADIANS ON 49M.

Signals from the low powered private stations of Canada are a feature of listening in the 49 metre band at the moment.

FOUR low-powered, privately owned commercial stations have been heard from Canada recently in the 49-metre band, all of them in the early evenings.

Strongest signal is from CFRX in Toronto using 6070 Kc. with programmes relayed from the broadcast band station CFRB. Signals are best at 7.30 p.m. The Sydney Nova Scotia station, CJCX, using 6010 Kc., opens at 7.45 p.m., when news is heard. At 8 p.m. a gospel programme is broadcast.

A further station in Nova Scotia, this one in Halifax, opens at 7.00 p.m. on 6130 Kc. This station has news, when opening, followed by a programme of cowboy numbers. Signals are good but, as the station uses the same frequency as VLT6 in Port Moresby, interference is severe. For more than an hour the signals of VLT6 and CHCX are very mixed.

A low-powered station in Montreal, CFCX has been noted at 8.30 p.m. on 6005 Kc. This station is listed as using only 75 watts and relays Radio 600 CFCF in the same city. Our reception has been very poor from this station, though it could improve before the end of October, when all these stations will revert to standard time, and then be received one hour later.

Colombian on 6010 K.c.

THE reception of a strong new Colombian station has been achieved in the evenings, when the station opens at 9 p.m. on 6010 Kc. This newcomer uses the slogan "La Voz Amiga" and is located in Pereira. Opening with identification, the transmission then contains many commercial announcements and Spanish music. In the early 1940s we verified a station in the 49-metre band which used this same slogan, and was also located in Pereira, and had the call sign HJFK. It is assumed that this transmitter has returned to the air under new owners and is using the frequency and slogan of its older namesake. The station gives the address as Postal Aereo 89, Pereira. "La Voz Amiga" is given frequently throughout the transmission and the station is scheduled to operate from 9 p.m. to 2 p.m. the following day.

Verification policy

TWO changes in verification policy have been brought to our notice by readers in recent weeks, namely changes in the attitude of Radio Peking to its short-wave reporters and the alteration in the verification policy of stations in Indonesia.

Radio Peking has advised that it will no longer verify reception reports on the local short-wave broadcasts in Chinese, which are intended primarily for reception in China. The reason is that the short-wave listener does not understand the language and therefore cannot submit an accurate report on what is being broadcast. This attitude so far is isolated but, if it should spread, it would mean that many local stations might become disinterested in distant reception. So far the interest and technical details from listeners over great distances is sufficient to make the station welcome any news of signals being received far from the transmitter.

Radio Republic Indonesia, which for many years has verified all the reports on the regional stations from Djakarta, now advises that reports can be sent to the stations themselves, as all the regional stations of Radio Indonesia have the facilities to verify reports on reception of these local stations.

The action of the B.B.C. in now verifying reports from listeners has been received with appreciation from readers, and we would suggest that your reports be as full of information as possible, as it will be expected that the Corporation will receive many reports from all parts of the world following this change of policy.

News from Africa

NEWS from Africa with its fast-changing radio picture of new stations and new countries coming on to the short-wave frequencies will be amongst the signals being received at dawn this month. From Cyprus the Middle East DX correspondent of Radio Australia supplies news of several new stations, which it will be possible to hear during this present season for signals from the dark continent.

RADIO GABON, using 9690 Kc., has begun experimental transmissions and this station is soon to commence transmissions on this frequency on a daily basis.

Notes from readers should be sent to Arthur Cushen, 212 Earn Street, Invercargill, N.Z. All times are Australian Eastern Time.

BELGIAN CONGO station OQE, using 4840 Kc., and with the power of 10,000 watts. The station is on the air from Tuesday to Saturday from 12.30 to 5 a.m. On Sunday and Monday the station leaves the air at the same hour, but opens two hours earlier.

Verification from the station is from P.O. Box 475, Bukavu, from Radio Bukavu in the Belgian Congo.

CAMEROON station at Doula, on 4910 Kc., is reported to be replacing its present 1,000-watt transmitter with one of 4,000 watts. The station has been heard on the present 1,000-watt transformer on 4910 Kc. in the mornings. This information came from the director of the station who, incidentally, is an amateur operating station FE8AN. It verifies reports from P.O. Box 986, Doula, in the Cameroons.

Higher power for VOA

The recent announcement that construction has commenced in the North Carolina area on high-powered equipment will mean better Voice of America signals in Europe. Six transmitters, each of 250,000 watts, are planned. The VOA recently advised that North Africa is the site of another relay station and it has now been revealed that this one is to be built in Liberia outside the capital, Monrovia. This station may take the place of the Tangier relay, which may be forced to close due to new Moroccan radio regulations prohibiting foreign broadcasting stations in Tangier.

Broadcasts from Brazzaville

THE change of the name from French Equatorial Africa to the Congo Republic and an increase in the schedule are two features of the Brazzaville transmissions, which will enable better reception, and a greater knowledge of this West African Republic.

Broadcasts from Radio Brazzaville are now on the air as follows:—

3 p.m. to 5 p.m. on 15,440, 11,725 and 9,730 and 5,970 Kc.

6.30 to 7.15 p.m. on 15,440 Kc

9 pm. to 9.58 p.m. on 15,440, 15,420 and 11,970 Kc.

10 pm. to 10.50 p.m. on 15,440 and 15,420 Kc.

11.30 p.m. to 1.15 p.m. on 21,500, 17,720 Kc.

3 am to 4 am. on 11,970 Kc

TANGANYIKA ON 4846 KC.

The recent assumption that Dar es Salaam's 4846 Kc. outlet replaces 3251 Kc has been found to be in error. This is a new channel brought into service using equipment loaned by the Uganda Broadcasting Service. The strong interference to the present 5050 Kc outlet resulted in the new frequency being put into service. The 20 Kw Marconi transmitter is used on 5050 Kc and 5Kw transmitter is on 4846 Kc. The station also has frequencies assigned as follows, 3251, 7167, and 9530 Kc. The Tanganyika Broadcasting Corporation is on the air 1.15 to 3.00 p.m., 7.00 to 9.15 p.m. midnight to 5.30 a.m.

FLASHES FROM EVERYWHERE

DJAKARTA has made a frequency change f its broadcast in English to Australia, which heard from 9.00 p.m. each evening. The tran mission has now been received on 9,585 and 11,79 Kc. The actual frequency announcement for t latter outlet is given as 11,785 Kc. A furth session in English is on the air from 10.30 p.r to 11.00 p.m., and is for English listeners in I donesia. This session is received at fair leve and, in this case, the frequencies of 7,270 ar 3,277 Kc. are in use.

RANGOON has dropped in frequency and r ports are that the station has been heard on 6.01 Kc. instead of its assigned frequency of 6,035 K The station has been heard at 12.15 a.m. at th commencement of its English transmission, whic is on the air to 1.15 a.m.

HAITIAN station 4VWI is now using 15,36 Kc. for a special session in English. It is o the air Mondays and Tuesdays from 1.10 to 2.0 p.m. The broadcast is also released on 6,000 Kc

TANGIER STATION IBRA Radio, which ha to give up its former frequencies, because the were outside the normal short-wave bands, ha been well received in the mornings on two new channels. The IBRA transmissions have been ob served on 9,730 and 15,285 Kc.

ISRAEL, with broadcasts from Tel Aviv, is now on the air in French from 6.00 to 6.30 a.m., and from 6.30 a.m. to 7.00 a.m. The session is in English. The station uses the frequency of 9,009 Kc.

BRAZILIAN station PSH, which has not been reported for many years, is again being heard with its local programs on behalf of the Brazilian Government. The transmission is on 10,220 Kc. and is heard from 8.45 a.m.; while another frequency of 14,683 Kc. is also used for the broadcast, which consists of news in Portuguese.

CONGO REPUBLIC has added some changes to its relay on "Radio Inter-Equatorial," which uses 9,545 Kc. to 5.00 a.m. After this time, it takes a 30 minutes relay from Radio Brazzaville and from 5.30 to 6.00 a.m. the station reverts to its own program. Radio Inter now continues its transmission to close at 7.00 a.m., using 7,295 and 4,795 Kc., the 9,545 Kc. being dropped at 6.00 a.m.

KENYA station of the African Broadcasting Service on 4,934 Kc. is being heard in Europe to sign off at 5.00 a.m. and this transmission should be audible in this area at this time.

SOUTH AFRICA, with its new 20,000 watt transmitters is being received over a wide area and interest is such that a special session for short-wave listeners may soon be a permanent part of the programing. The SABC are interested to learn of reception of the various transmissions and request reports to Tony Collocott, P.O. Box 1226, Port Elizabeth, South Africa. The transmissions on 25,800 Kc. in the 11 metre band continue to be heard in Europe from 12.15 to 3.00 a.m. English is on Wednesday, Friday and Sunday, with Afrikans on the other days.

NIGERIAN Northern Regional station at Kaduna, now broadcasts as follows: On 3,226 Kc. from 3:10 to 6.00 p.m., and 2.45 to 8.15 a.m. The frequency of 6,175 Kc. is on the air from 7.30 p.m. to 2.30 a.m.

DAKAR has dropped the slogan of "Radio Dakar Inter" and is now "Radio Mali la Radiodiffusion de la Federation du Mali." The station operates 4.30 to 6.00 p.m., 10.00 p.m. to midnight, 5.00 to 9.30 a.m. The station uses 4,950 Kc. with 4 Kw. from 5.00 a.m. to 6.00 p.m., the program also being radiated on 7,210 with a power of 25 Kw. It transmits on 11,895 Kc. with 25 Kw. between 10.00 p.m. and 5.00 a.m.

WEST GERMAN station using the slogan "Radio Free Russia" is using programs in Russian. 7.30 to midnight, on 6,310, 11,636 Kc. From 11.00 p.m. to 12.25 a.m. using 4,040, 8,755 Kc., 2.00 to 5.30 a.m. on 11,636, 15,290, 2.30 to 3.00 a.m. on 4,950 Kc. The address of the station is P.O. Box 902, Rotterdam, Netherlands.

BELGIAN CONGO regional station, "de Coquilhatville," operates on 5,993 Kc., with the call-sign OPD2 and the power of 10 Kw. The station is in French and Kiswahili, from 1.30 to 6.00 a.m. The station has news in French at 4.15 a.m., and verifies reception reports with a letter, the address being Boite Postale 1061, Coquilhatville, Belgian Congo. The station also plans an afternoon transmission from 2.30 to 4.30 p.m. and 8.30 to 10.30 p.m.

CAMBODIA with broadcasts from Phnom-Penh, has a foreign service, using 6,090, 7,183 Kc. with English 11.15 to 11.30 p.m., then Thai to 11.45 p.m., Vietnamese to midnight, French to 12.30 a.m.

AMATEUR BANDS WITH BILL MOORE

The 1959 Remembrance Day Contest was again well supported, with hundreds of amateurs throughout the Commonwealth participating. It was officially opened this year by His Excellency the Governor of Queensland.

THE WIA's 1959 Remembrance Day was officially opened by His Excellency the Governor f Queensland, Colonel Sir Henry Abel Smith, .C.V.O., D.S.O. It was appropriate in view f 1959 being Queensland Centenary Year that ne opening should be made from that State.

Tapes were prepared under the Federal WIA all VK3WIA and broadcast over official WIA tate Stations just prior to the commencement of he contest.

His Excellency spoke of the work of the Ausralian Amateur in emergency. Especially menioning Queensland amateurs' assistance during ne Bowen cyclone earlier in the year. Amateurs or a period provided the only means of contact vith the devastated area, and their efforts greatly nitigated suffering.

Sir Henry also spoke of the work of the Flyng Doctor and the late Dr John Flynn and of he origin of the two-way radio service. His Excellency, in his remarks, covered the value and bility to promote international friendships not imited by iron or silk curtains. The Governor hen declared the 1959 RD Contest open.

At the conclusion of the opening ceremony Stan Armstrong, VK4SA, then read the names and all signs of amateurs in the various services who gave their lives in World War II. Their alls are engraved on the perpetual trophy for vhich the Divisions of the WIA compete each year. Stan then recited the ode to the fallen.

Eighteen hundred hours saw the bands open and amateurs throughout the Commonwealth compete n the contest.

Activity was relatively high especially on telephony but some of the CW stalwarts were missing.

Some high scores especially amongst the VK6s should be recorded but it is doubtful if scores generally will reach last year's all-time high. This year, during the early hours, the bands were devoid of contest signals and this feature reflected on a number of scores.

The review after 1800 hours on the Sunday evening provided much interest; there were strained voices and even some sighs of relief.

High scores in N.S.W. will include VK2AHH who passed the 1,000 mark, VK2ASZ, VK2DO, VK2RS and others.

The 28 mc/s band did not provide many contacts but the other bands performed to the usual standard for the time of the year.

Another RD Contest has come and gone with the renewal of many wartime friendships with interstate amateurs.

WIA NOTES

THE August meeting of the N.S.W. division was held at Science House and 36 new members were admitted, including 13 to full membership. State president Dave Duff, VK2EO, was in the chair and Tim Mills, VK2ZTM, was recording secretary in the absence of Norm Beard, VK2ALJ, on holidays.

Lecturer for the evening was Frank Hine, VK2QL, and his subject Ionospheric Prediction Charts and Their Interpretation. Frank, an expert on such matters, had much experience during many years' service as a signals officer in the R.A.A.F.

He had to limit the coverage of the subject to single-hop F2 layer transmissions, but will lecture again to cover other propagation modes.

The lecturer distributed charts to allow members readily to follow the discourse. Frank also discussed the effects of magnetic storms and daylight fadeouts and pointed out the dangers of working too close to the M.U.F. over any route and suggested the use of the O.W.F. (Optimum Working Frequency). He also described radio operation in the polar regions.

In those areas, for 30 to 40 per cent of time, the H.F. bands are completely dead.

Frank's lecture was greatly appreciated and future appearance will be awaited with interest. Visitors to the meeting included VK5ZW and VK5OM.

OLDTIMERS' NIGHT

The October meeting of the N.S.W. division will be a special oldtimers' night and they will be invited to attend and bring along pieces of vintage equipment for display. Several of the more "ancient" amateurs, including Wal Hannam, VK2AXH, Joe Reed, VK2JR, and Lionel Swain, VK2CS, will provide gear, some of it dated back to pre-War I. The meeting will take place on October 23 at Science House, Gloucester Street, Sydney. A cordial invitation is extended to all amateurs of 25 years' standing, whether active or not, to attend.

Lecturer at the N.S.W. V.H.F. and TV section's meeting for November will be Doctor R. J. F. Guertler, of the University of N.S.W. The doctor, an expert on antennas, designed one of the Sydney TV station's array. He will discuss aspects of aerials, feeding, etc. The meeting will be held on Friday, November 6, at the Gore Hill Technical College.

VK2WI Dural is now fully equipped for working under any conditions with the 25 K.V.A. motor generating set in operation.

Tests have been carried out using the emergency supply. Members who worked hard to get the equipment operational are Morrie Gascoyne, Allan Walker and Fred Orvad. Lou, VK2AWS, provided the wire necessary to bring the power from the machine shed to the station proper.

Much scrub clearing has also been carried out in preparation for the bushfire season.

ITU CONFERENCE

THE tape recorded by the W.I.A.'s representative at I.T.U., Geneva, John Moyle, VK2JU, provided an insight into his appreciation of the position with reference to amateur frequencies. The tape ran for 10 minutes.

At the time of recording the proposals from all nations were not available for dissection.

The tape provided an assessment of activity and proposals submitted to date and an indication of changes that might be expected to the frequency allocations.

Subsequently late in August questions were asked in the Senate by Senator McManus.

They were directed to Senator Cooper representing the P.M.G. and were an inquiry as to whether the original F.A.S.C. proposals cutting amateur bands had been modified.

Senator Cooper stated there had been no changes to the original proposals as published and discussed the frequency requirements of all services. A rather questionable statement was made to the effect that the W.I.A. had represented the Radio Amateurs on F.A.S.C. The Federal president, Max Hull, VK3ZS, had previously stated on a number of occasions the circumstances under which W.I.A. delegates attended these meetings.

The proposals had already been framed before they were invited to put the position for the amateur. The only interesting point that arose from Senator Cooper's statement was that the allocations as proposed could be varied at Geneva to fall in line with the proposals of other nations.

VHF DX NOTES

50 mc/s DX still continued in the winter months, mainly restricted to amateurs of the world whose locations favour T.E. propagation working. The VKs obtained their share of such distant contacts. LU2FAO recorded 16 different countries in his 50 mc/s monthly I.G.Y. report. The JAs have been consistently breaking through to VK4 and earlier KH6 was working with VK9. HB9 Switzerland to ZU and ZE was another path open for many weeks and VS6CJ worked with KR6, VU2, VK4, DU and VK9 in the winter period.

The VK4s still continue to contact JAs consistently on 50 mc/s, Vern Kerr, VK4LK, Charters Towers, is planning to work with VK4ZAK, of Townsville, on 288 mc/s. VK9XK is another still working JAs and in August QSO'ed VK4NG.

The JAs were heard in Melbourne on August 10, VK3AZY and VK3CI recording contacts. In mid-August 50 mc/s opened for interstate working between VK4 and VK3, 5 and 7.

One of N.Z.'s leading 50 mc/s enthusiasts has now contacted more than 100 Ws on that band. He is ZL1BJ.

These are mostly W6s with odd W5s and W7s, he has also heard W8 and W4. ZL1 stations have now contacted JA, KH6. W, LU, PY, VP6 and KP4 on the band.

On August 20, 50 mc/s again opened to JA with VK4NG appearing for a few minutes in VK3. In Sydney little has been heard in recent months.

YJ1DL ex ZC3AB, VK4DL, VK2DE, is expected to open on 50 mc/s this summer after becoming fed up with the RST 73 contacts of the HF bands. It was his idea to operate on 51.5 mc/s, but W1DHQ is trying to persuade him to move to the low edge.

Everyone in Australia appreciates the contribution the Z calls have and are still making to the amateur service in the V.H.F. portion of the radio spectrum. They have greatly assisted in popularising the 50 and 144 mc bands, have opened new paths on both allocations, and contacted more than their share of 50 mc DX.

Interesting graphs have been published in Q.S.T. showing the increase in activity in the annual A.R.R.L. V.H.F contest with the influx of technical and novice licencees to the VH.F. bands.

From 1951 to 1958 the number of entrants rose from 300 to 1,200 amateurs, a fourfold increase An interesting feature of the contest has been the tremendous rise in 50 mc/s participation since 1955, which increased eight times. 144 mc/s logs dropped in number since that date.

With the best of the 50 mc/s DX now over and a continued fall off until the next sunspot maxima, it will be interesting to see if the 50 mc/s participation continues at the same level.

The populating of the V.H.F. bands by new types of licencees has been an important forward step in the history of the movement and these amateurs should receive every encouragement.

CCIR AND AMATEURS

AN outtsanding operation in amateur radio was the installation of station K6USA by the Los Angeles Council of Radio Clubs at the Biltmore Hotel in that city. The occasion was the 1959 meeting of the C.C.I.R. (International Radio Consultative Committee) when representatives from all over the world gathered.

Running 24 hours per day K6USA averaged 400 contacts in the period and contacted 91 different countries. A special bill was passed in the U.S. Congress to permit foreign amateurs attending the conference to operate the rig.

The station was manned by amateur volunteers from all parts of southern California. Emphasis was on foreign contacts and third-party messages for C.C.I.R. delegates were handled where their countries permitted such traffic.

Much of the station equipment was donated by various manufacturers and included 4-IKW transmitters. The A.R.R.L. presented the 15 foreign amateurs attending with special clothbound copies of their handbook.

The whole project was extremely successful and

DATES FOR AMATEUR CONVENTIONS

WITH the coming of spring and kinder weather, October is always a busy month in amateur radio. In N.S.W., the first two shows are the Hunter Branch Dinner and Field Day and the South-Western Zones Annual Convention, this year to be held at Narrandera. Both these events are held over the Six-Hour Day weekend and amateurs are invited to attend. The phone section of the VK/ZL DX is also conducted over the same weekend and runs between the hours of 1000 G.M.T. Saturday, October 3, to 1000 G.M.T. Sunday, October 4.

The C.W. section is conducted on the following weekend between the same hours. Rules as similar to last year and the usual serial numbers must be exchanged.

Later in the month the Blue Mountains section of the W.I.A. will conduct their annual field day. The date is Sunday, October 25, and the venue Lawson, half-way up the mountains. An easy run from Sydney, the event attracts a good number of amateurs from the metropolis.

The actual convention location is in the swimming pool grounds and signposts will direct the way from the centre of the town.

A full program has been arranged with excellent prizes and events include the usual 144 mc/s hidden transmitter search, blindfold hunt and 7 and 144 mc/s scrambles.

A bus tour of the sights has been arranged for the ladies and children during the afternoon and will cover some of the best scenic views in the Commonwealth.

The section's rooms are within a few yards of the pool and amateurs will be able to meet there.

Registration takes place between 10 a.m. and 10.30 a.m.

The N.S.W. W.I.A. Sunday broadcast will be originated from the rooms via a 144 mc/s link to VK2WI Dural for re-broadcast.

The 144 mc/s hunt is scheduled for the morning and the scrambles on 7 and 144 mc/s in the afternoon.

Farewells and prize presentation will take place at 4.15 p.m. Ice creams and drinks will be provided free for the children and cups presented to the winners of the field events.

Keep Sunday, October 25, clear for that run to the mountains. It should be a good day's entertainment in pleasant bushland surroundings.

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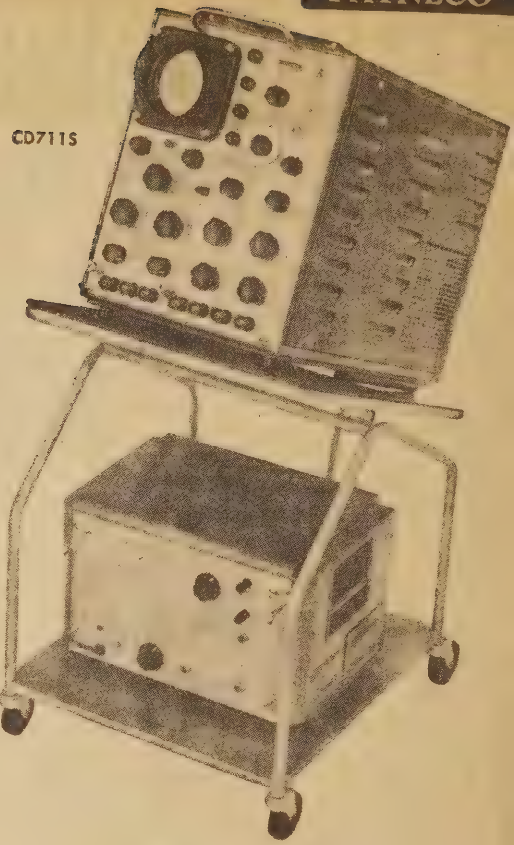

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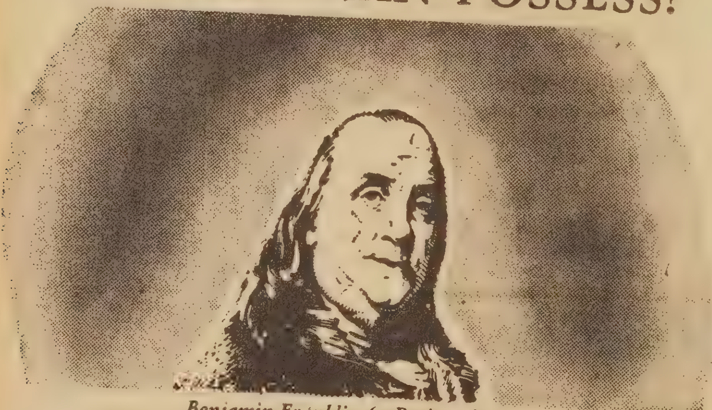

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Why was this man great? How does any-one—man or woman—achieve greatness? Is it not by mastery of the powers within ourselves?

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afforded the amateur service with valuable publicity.

The operation was effectively summed up by a Czechoslovakian delegate, who said amateur radio could do more for world relationships than all he diplomatic corps in the universe.

ARRL DECISIONS

THE annual A.R.R.L. board meeting's decisions can often have decided effects on the workings of overseas amateurs, such as decisions on the proposed extension of the U.S. telephony allocation to the high end of 14 mc/s.

With the total number of amateurs in the U.S. now close to 190,000, any decision varying their mode of operation must be felt in many places.

This year's board meeting was mainly concerned with domestic matters and the few motions on regulatory matters were lost by vote.

Interesting highlights included the possibility of the presentation of a TV program covering amateur radio activity. The idea would be for a live presentation to be filmed at cost to the A.R.R.L. and to be shown over other stations.

In line with most amateur societies it was decided to raise the subscriptions for all classes of members. Some idea of the magnitude of the A.R.R.L.'s administration can be gleaned from the appropriations: £8,000 for directors' actual expenses, £3,000 for Q.S.L. and Section Communication Managers' travel expenses.

£11,000 was set aside to defray the expenses of league participation in the I.T.U. conference.

The league is a large business and publishing organisation and the bank balance was around the £100,000 mark at the end of the financial year.

The A.R.R.L. will publish in the near future a novice handbook for the use of beginners in the hobby. The expansion of the league has been so great they are looking for new headquarters.

28MC INTERFERENCE

M. Urquhart, VK6MU, brings to notice a 28 mc/s interfering signal that has caused trouble in recent years. In the hope that some amateur may be able to pinpoint the offending source, he supplies the following information:

For at least five years now an offensive power hum noise racket has been operating on frequencies in the 28 mc/s band and from all accounts on a wide range of frequencies outside the amateur bands. It is seldom heard on a Sunday.

The nature of the noise suggests diathermy as being responsible and it continually drifts in frequency. Beam rotation suggests it is located in the south-eastern portion of the Australian continent. These checks have been made by many amateurs in Australia, New Zealand, Fiji and elsewhere. It can, under favourable conditions, be heard over most of the globe, but should not be confused with similar noises emanating from Europe.

Even under present conditions (July) it runs an S7 to 8 signal into Western Australia daily.

The radio branch has been advised and it is understood they have been unable to locate the source.

A great service would be performed by anyone locating it.

VK6MU would be pleased to hear from any amateur or listener who could assist. Perhaps someone lives close by and with skip problems on 28 mc/s this would appear to be best possibility of tracking down the machine causing the interference.

LIST OF COUNTRIES

THE A.R.R.L. has further clarified its country list policy for D.X.C.C. awards in view of a number of suggestions that the list should be frozen.

The League points out that the changing political and geographic features have to be taken into account in any list policy. The political framework in recent years has varied considerably and is still subject to change.

If there were no changes made to the list it might stabilise the DX field for the moment.

In a few years, possibly even months, the list would be so far out of date that it would be the subject of ridicule with such obsolete listings. The League, however, appreciates that areas such as Long or Catalina Islands should not be raised to country status as they have no pronounced geographical separation or autonomy from the parent nation.

Without any pretense to suggest their list is perfect, the A.R.R.L. points out it is built on specified policies and the fact remains there must be a reference list for all comers to follow.

The League rests the case for a given country decision on three major points. Before deciding one way or the other, details are assembled from leading authorities on political and geographic matters. The criteria are: 1. Political administration independence. 2. Geographical separation. 3. If the given areas have any foreign land between them. Many details have to be weighed, so there is an advisory staff group of seven, all postwar D.X.C.C. members, to review the maps and the case presented.

Geographical separation from the mainland may serve to swing an area into a place on the countries list even when political separation is not complete. Likewise the form of government itself, degree of autonomy, may take precedence.

In the final analysis, when a new country is added, or an old country taken off, there is a good reason for the change.

STEREOPHONIC EQUIPMENT

POINTERS ON BUYING

BE CAREFUL OF YOUR FRIENDS

Your friend may have read a few more advertisements than you have. This does not make him an authority. Remain sceptical when he describes the X speaker as the only possible choice and has never heard it.

BE CAREFUL OF SPECIFICATIONS

One well known speaker has a useful frequency range of 30-14,000 cycles in England and 20-24,000 cycles in America. One popular stereo cartridge has a frequency range of 40-12,000 cycles in England and 30-24,000 cycles in Australia.

DON'T BUY ON NAME ALONE

Remember there is as much difference between a 8in and a 12in in some of the good speakers as there is between a G.M. Holden and a G.M. Cadillac.

DON'T SPEND TOO MUCH ON YOUR AMPLIFIER

Though there is a difference between a good and a superlative amplifier there is a far greater difference between a good and a superlative speaker.

DON'T TEST THE EQUIPMENT SOLELY ON DEMONSTRATION RECORDS

The number of persons who can tell the difference between a distorted and an undistorted train is very limited.

DON'T TRY TO BUY THE "BEST"

We don't know what it is and we have never met anyone who does. But with our wide knowledge of the equipment available and the music it is meant to reproduce we can help find what is best for YOU.

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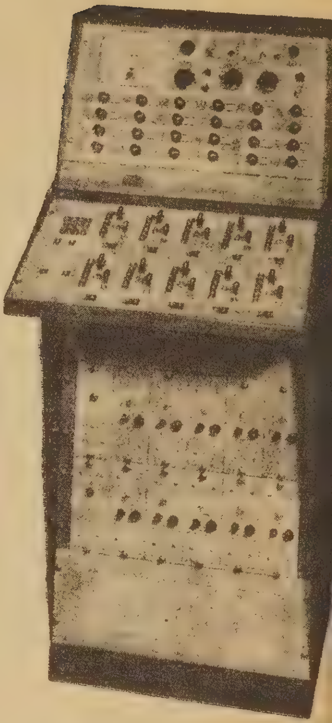

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THE SERVICEMAN WHO TELLS

(Continued from Page 45)

or about 1.8 inches in the case of a 21 in. receiver.

Now, assuming we have a ghost displaced by exactly 1.8 in. from the main image, what does it tell us?

It tells us that the path length between the transmitter and receiver has been increased by one mile but—and this is most important—this is not the same as saying that the reflecting object is one mile away.

It could be at almost any distance between the transmitter and receiver and to one side of the line of sight by whatever amount was necessary to increase the path length by one mile. About the only location it could occupy where the calculation would be valid would be to one side of the receiver almost at right angles to the line of sight.

If it were directly behind the receiver, then the path length would be increased by twice the physical distance, making the latter equal to half a mile in the case we have been considering.

However, these points seem to be of little more than academic interest since they mean, in effect, that we have to know where the object is before we can calculate its position!

To be truthful, this is not quite fair. Such calculations do have a practical value, but it is mainly to provide confirmation where we suspect that a certain object is causing a ghost.

NATURAL REACTION

A natural reaction, when a ghost problem is encountered, is to blame the "bridge" or the "gasworks" or whatever happens to be the most prominent structure in the district, and much time and effort may be wasted trying to cure the problem on this basis when, in fact, it is due to a completely different cause.

For this reason it is always a good idea to make a brief calculation of the increased path length involved and a few more calculations to see if the suspected object could possibly fit into the distance involved. It is surprising how often the "obvious" or "popular" culprit proves to be so far removed from the figures that it could not possibly be responsible.

This technique is particularly useful where there are several objects which might be causing a ghost, but where it might be difficult to decide which is causing the worst one, or even the only one. Once this point is clarified some idea can be gained as to the type of aerial which might be the most useful by reason of its field pattern.

A typical case might involve a hill close behind a set and another larger, hill much further away to one side. Before trying to select an aerial which might minimise a ghost we would have to know which hill is responsible. Then we can pick one having either a minimum rear pickup or a minimum side pickup. In such a case, the differing distance to the two hills should allow us to calculate which is the most likely culprit.

So hunt your ghosts with a slide rule by all means, but make sure you appreciate all the limitations, as well as the possibilities.

A READER BUILT IT

(Continued from Page 87)

speakers which had a frequency range of from 40-10,000 cps. These I acquired for £6/10/ each wholesale. I have temporarily mounted them in the radio cabinets but I put them on a reasonably thick baffle and put a heavy back in the cabinets.

"The OP transformers that were on the sets were not nearly good enough for what I wanted, so I went to the disposal store and searched till I found two suitable ones. I mounted these and connected up the whole system. The cost for the transformers was £1 each and the cost for the two extra controls cost just under £1.

"On trying it on some new stereo discs I had bought I was amazed at the results. Good, clear, balanced, undistorted sound came from both speakers giving the full stereo-effect."

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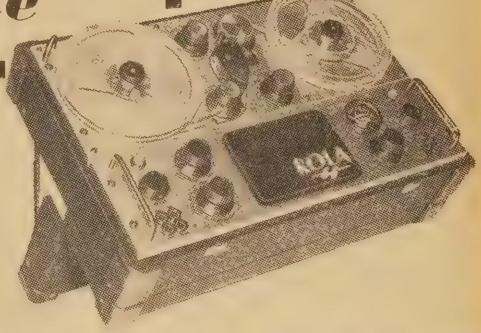
MODEL 66 GENERAL PURPOSE



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FAST FORWARD AND REWIND TIME	45 seconds for 1,200 ft. reel.
TIMING ACCURACY	± 0.1% (± 1.8 seconds in 30 minutes.)
FLUTTER AND WOW	Better than ± 0.3% at 3¾ i.p.s., 0.25% at 7½ i.p.s., and 0.2% at 15 i.p.s.
FREQUENCY RESPONSE	At 3¾ i.p.s. 50-6,000 c.p.s. ± 3db; at 7½ i.p.s. 40-10,000 c.p.s. ± 3db, or 30-14,000 c.p.s. ± 6db; at 15 i.p.s. 40-15,000 c.p.s. ± 3db, or 30-18,000 c.p.s. ± 6db.
DISTORTION	Less than 1% Play or Record.
LEVEL METER	dB calibrated for visual monitoring.
MONITOR LOUDSPEAKER	Inbuilt Rola loudspeaker with its own level control:
INPUTS:	
Microphone	High impedance. Requires input signal of less than 1 mV for normal recording level (+ 8 dbm at 600 ohms).
Bridge	Single Jack. Requires input signal of 80 mV.
600 ohms	Twin Jack. Requires input signal of —12 dbm (200 mV).
OUTPUTS:	
600 ohms	Twin Jack.
External Speaker	Single Jack to 15 ohm voice coil.
Headphones	Single Jack.
	All Inputs and Outputs on Front Panel.
RADIO TUNER	1,650-550 K.C. Optional Extra. When fitted forms integral part of amplifier.

ROLA

ROLA COMPANY (AUST.) PTY. LTD.
THE BOULEVARD, RICHMOND, VIC. JB 3921
CALTEX HOUSE, KENT ST., SYDNEY, N.S.W. BU 6147

ACE RADIO

Amplification Communication Electronics

PHONE
LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W

636 KING STREET, NEWTOWN—LA7008

R. TV & H. '59 TV

21 inch 110 DEGREE

The complete kit of parts to R.T.V. & H. specifications and layout including: VALVES, TESTED STEANES TURRET TUNER & I.F. STRIP, TUBE MOUNTS AND MASK.

£105/0/0

WIRED AND TESTED £12/-/- EXTRA

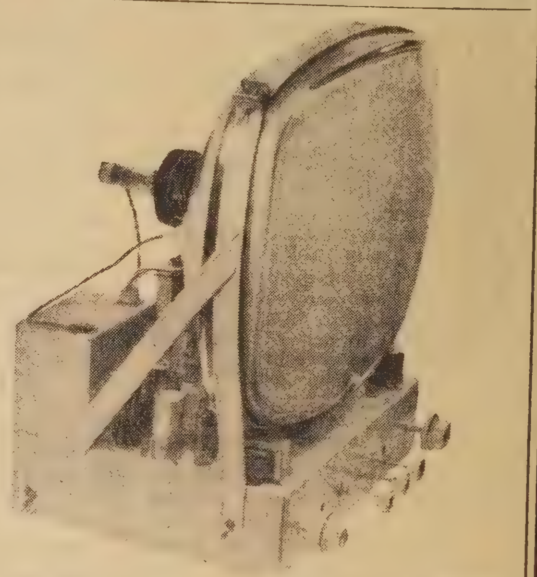
FOR FRINGE AREAS

17 Valves, 4 stage Strip. Prealigned and tested.

PHILIPS NEW HIGH GAIN TUNER £107

Any individual parts, I.F. Strip, etc., can be supplied to order. Prices on application.

Chassis and E.H.T. Cage for R.T.V. & H. '59 TV Set £2/7/6.
Wired and tested Video Strip with Valves—£11/15/



RECORDING TAPE

Hi-coercivity tape, ex A.B.C. stations

1200ft spools	£1/12/6
500ft spools	19/6

TRANSISTORISED CAR RADIO

No power supply. No noise
Greater sensitivity.
12 volt operation.
Complete with aerial, speaker.
Simple installation.

£34/15/-

6 Volt Operation, £35/15/-
State aerial and speaker required.

STEREO 4-SPEED PLAYER
£14/17/6
STEREO 4-SPEED CHANGER £17/17/6

AMPLIFIERS

Public Address Range
240v-AC

6 Valve, 10 watt,	£14/17/6
6 Valve, 25 watt,	£25/7/6
6 Valve, 40 watt,	£32/7/6

Battery Operation

6 Valve 6v, 10 watt,	£18/15/
7 Valve 12v. 12 watt,	£19/15/
7 Valve 12v. 25 watt,	£24/17/6

BATTERY—AC OPERATION

6 Valve 6 x 240 10 watt,	£20/15/
7 Valve 12 x 240 12 watt,	£21/15/
7 Valve 12 x 240 25 watt,	£29/7/6

STEREO RADIOGRAM KITSET

8 VALVE
Dual Wave Stereogram, Octal Series Valves.
10 Watts Output,
2 Jensen 12in Speakers
Bass and Treble Control,
Complete Kitset, including Valves, Speakers, Circuits.

£29/17/6

Wired and Tested.

£33/17/6

TRANSISTOR PORTABLE

Complete Kitset including Plastic Covered Cabinet and Circuit.

KITSET	
6	**7**
£26/10/-	£29/-/-
Wired and Tested	
£28/10/-	£32/-/-

D.C. TO 240 V A.C: INVERTERS

6V Input 40 watts.
12V Input 60 watts.
32V Input 60 watts.

£9/17/6

6V Input, 60 watts, 50 cycles.
12V Input, 100 watts, 50 cycles.
Suitable for Radiograms, Tape Recorders.

£16/17/6

TV I.F. STRIPS

Complete with Valves
Aligned and Tested
Your pick from Steanes
R.C.S. Mahood coils
from £11/15/-

TV KITSETS

14in Q Plus	£99
17in Q Plus	£105
21in Q Plus	£115
21in Ace	£105
21in R., T. and H., 59	£105

Wired and tested, £12 extra.

TV ANTENNAE

A complete range from

£4/15/-

Send for full details on Radiogram Chassis, TV and Amplifiers.

21in PICTURE TUBES

90 or 110 degree. Fully guaranteed.

£23/15/-

TV TURRET TUNERS

Steanes, Philips, Mullard, Astor
From .. ..

£12/10/-

VACUUM TUBE VOLTMETER

Voltage Ranges: DC-3-10-30-100-300, 1000.
Resistance Ranges: 1000-10,000-100,000.
1 meg., 10 meg., 1000 meg.
1 p.c. accuracy. To 300 V. and 10 meg. range.

£29/-/-

30K. V. Extension Probe.

£7/15/-

STEREOGRAM CHASSIS

Dual Wave with R.F. Stage.
8 VALVE. 6BA6, 6AN7, 6N8, EM80, 12AT7, 6BM8, 6BM8, 5Y3.
2 Rola 8MX Speakers.

£36/15/-

10 VALVE. 6BA6, 6AN7, 6N8, 12AT7, EM80, 2 x EF86, 2 x EL84, 5V4.
2 Rola 8MX Speakers.

£46/15/-

12 VALVE. Dual P.P. 14 watts output.
6BA6, 6AN7, 6N8, EM80, 2 x EF86, 4 x 6BM8, 12AT7, 5V4.
2 Jensen 12in Woofers,
2 Jensen 6in Tweeters.

£55/-/-

15 VALVE. 2 x 6BA6, 6AN7, 6AV6, 6BR5, 2 x EF86, 12AT7, 2 x 12AX7, 4 x EL84, 5AS4.
4 Jensen Speakers.

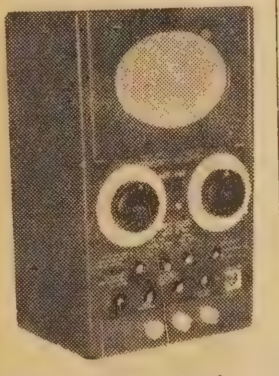
£63/15/-

A C E
Amplification
Communication
Electronics

★★★★★★★★★★★ RADIO

PHONE
LA 3845

136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N·S·W
AND 636 KING STREET, NEWTOWN—LA7008
EVENINGS and WEEKENDS: "KALUA," Hilma St., Collaroy Plateau—XW5956.
DULWICH HILL, UNDERCLIFFE, EARLWOOD BUS AT DOOR, STOP No. 42



AR8 Communications Receivers

12 valve. Converted to 240v A.C. Thoroughly Tested. Re-aligned. Latest Ovaltone Permag. Speaker.

£34/17/6

NEW VALVES

12C8	12/6
6J8	17/6
VT501	12/6
2D21	15/
1C6	12/6
1J6	12/6
6A6	12/6
3A4	15/
3B7	10/
3D6	10/
6AG5	7/6
6AM5	15/6
6AM6	17/6
6H6	2/6
1K7	5/
1M5	5/
6X4	12/6
12AT7	17/6
832	£2/10/
6J5	9/6
834	5/6
9003	12/6
6J6	15/
6J7G	7/6
6N7	10/
12A6	2/6
KTW62/6U7	7/6
1D5	7/6
CV6	3/6
6F6	12/6
VR65A/SP41	2/6
6X5	10/
6V6	12/6
1Q5	2/6
6E5	12/6
12K8	12/6
1T4	10/
3S4	10/
803	£1/5/
VT502	12/6
1L4	5/
6K6	7/6
6SK7	15/
AV11	3/9
6K7	5/
12SJ7	12/6
12SK7	5/
12SL7	12/6
39/44	10/
47	12/6
843	£1/10/
957	10/6
1625	£1
1629	10/
1619	£1
2050	£1
9001	8/6
RK75	10/
VR75/30	15/
RK48A	£3
954	7/6
VR105/30	15/
1C7	2/
7193	3/6
EL3NG	12/6
83	10/
EMI	12/6
866A	15/
6AC7	2/6
EF50	2/
100TH	5/
5R4GY	£1
6AJ5	9/6
EA50	2/6
1K5	2/6
6SN7	12/6
809	5/

BENDIX 221 FREQUENCY METERS

Excellent condition. Tester.

£45/-/-

NEW C.R.O. TUBES

Suitable for TV Pic. Tubes.

VCR 139A, 2¾in	£1	10	0
VCR 138A, 3in		17	6
VCR 97, 6in	£2	17	6
5FP7 Flying Spot, 5in		17	6
CV112		10	0
CV1957		9	6
906	£1	7	6

NEW VACUUM PUMPS

An excellent Low Pressure Air Compressor. 7 c.f. per min. 25lb pressure.

£2/7/6

NEW POWER TRANSFORMERS

285 x 285V 60mA	£1	17	6
285 x 285V 80mA	2	7	6
285 x 285V 125mA	3	7	6
325 x 325 150mA	3	15	0
250 x 250 175mA	3	15	0

C.R.O. Transformers

350 x 350v extended to 1000V 6.3. 6.3-2.5 4V filaments.
£4/5/.

Vibrator Power Transformers

6V 300 V 125mA	£3	12	6
12V 325V 125mA	£3	12	6

TV Power Transformers

295V 300MA	£6	15	0
295V 400MA	£8	5	0

Inverter Transformers

6V 240V 40 Watt	£3	7	6
12V 240 60 Watt	£3	7	6
32V 240 60 Watt	£3	7	6
750 x 750V 750mA	£7	10	0
240V to 110V 2KVA	£10	10	0

RELAYS

6V, 3-Pole Miniature	15/
1700 SPDT	7/6
1300 SPDT	7/6
500 x 500 SPDT	7/6
12 volts DPDT, 5 amp	£1
12 volts DPDT	12/6
11 volts A.C.	£1
Hi-speed Polarised relay	£2/10/
400 ohm	12/6

Hi-lo Phono Transformers	4/6
Spirit Level Bubbles, mounted	4/6
Canadian Signal Lamps	7/6
Hi-voltage, Lead-thru Insulators each; 15/ doz.	1/6
Hydrometers, Battery Testers	5/9
Torches, 2-cell, Focusing	6/9
Multi-Strand 4-Core Cable, yard	1/
100 yards	£2/17/6
Tx Var. Condensers, 300 pf	£1/5/
60pf with Vernier	£1/1/
30 pf	10/
Throat mikes, new	3/6

OIL FILLED CONDENSERS

.5mfd 600V	3/6
2mfd 600V	6/6
.2mfd 2500V.	15/
1mfd 600V.	6/6
.4mfd 600V.	6/6
4mfd 4000V.	35/

A.W.A. STANDARD 3-GANG CONDENSERS

10/9
Postage 2/6.

NEW 6V RELAYS

P.M.G. type 3000. 3 makes, 3 breaks.

7/6
Post 1/.

GENEMOTORS

Input	Ouput					
24v.	250v. 100mA		£1	0	0
24v.	550v. 375mA		£2	0	0
24v.	250v. 60mA		£1	5	0
12v.	500v. 350mA		£8	10	0
12v.	1200v. 200mA		£6	10	0
24v.	250v. 100mA.	New	£2	0	0
12v.	235v. 50mA		£2	15	0
12v.	350v. 50mA		£2	15	0
24v.	540v. 200mA.	New	£2	15	0
24v	300v. 205mA.	New	£2	15	0

NEW 24V MOTORS

Series wound Hi-speed miniature. 12.000 R.P.M. £2/10/
Shunt wound with gearbox, 2 speed and 5 and 25 R.P.M. £2/10/

AMERICAN WALKIE TALKIE 536

Complete with valves, 1 crystal, coils.

Good condition £6/17/6
Postage 7/6.

Matched crystals and coils for 536 and 611 Units £2/10/
Per Set. Postage 1/.

NEW 24 to 32V DC

Vibrator Power Supplies

Regulated, Filtered, 125V DC

£1/17/6

VALVE & CIRCUIT TESTERS

Transmission Products Units. 240 A.C. 6v D.C. Includes Socket Modification Panel, Valve Charts. Tested. Perfect order.

£22/10/-

MINIATURE HI-POWER MOTORS

With Gearbox.
100 to 1 reduction, 24v. Reversing. Ideal beam swinging unit.

£2/17/6

New Smith Aircraft CLOCKS

8-day movement. Cost Govt. £28.

2¾in	£4/15/
2¾in with sweep hand	£5/15/

New Coils and Intermediates

Standard or miniature to suit all valves.

Coils B/C, 455 KC	9/6
Coils SW. 455 KC	9/6
Inters	11/6
Loop aerial coils	9/6
Slug tuned H.F. coils to suit 44 meg.	4/6

TELEPHONES

Standard P.M.G. Type. Pedestal Magneto Phones. Tested. In perfect order.

£6/10/-

NEW R.F. METERS

0 to 1 amp. 0 to 350mA.

10/6

Used meters as above, 7/6.
Postage 1/.

WANTED

Communications Receivers, Test equipment, P.A. Gear, Large or Small surplus stock, Best prices. Call, write or phone any time.

DYNAMIC HEADPHONES

Low impedance 17/6
Postage 2/6.

Dynamic microphones, type 7, 12/6
Postage 2/.

NEW VALVE SPECIAL

Cartons of 50, Any type or assorted to your order.
6AC7, EF50, 6H6, CV6, 7193, 1M5, 1K7, 1Q5, EA50, VR65A

£6/-/- PER CARTON

NEW 3BZ TRANSMITTERS

12v. operation. 2 to 10 Mgs. Air tested. Perfect order. Complies with P.M.G. requirements. For small ships, bushfires and all other services.
COMPLETE WITH 1 CRYSTAL.

£32/10/-

NEW BENDIX V.H.F. SIGNAL GENERATOR

Batt. operation. 170-220Mcs.

£1/15/-

Receivers. Above freq. batt. operation.

£2/17/6

Easy conversion for 144 megs.
Postage, either unit, 6/6.

F.M. AMERICAN Pack Set Walkie Talkie

17 miniature valves, 40 channels, 27 to 38 megs. Batt. operation.
Complete with valves . . . . . .

£12/17/6

N.B.: This is the unit used by commercial B.C. stations for outside sports broadcasts.

12V GENEMOTORS

English, 12V in, 250V out. 50mA.

£1/7/6

522 TRANSCEIVERS

Complete with Valves.
Excellent Condition.

£12/10/-

522 Receivers with Valves	Complete £5/17/6
522 Transmitters. with Valves.	Complete £7/15/-

NEW 2V ACCUMULATORS

70 amp Hour, Dry Charged.
Hard Rubber Case.

15/-

NEW INSTRUMENT CASES

Steel with hinged cover and fastener, 8in x 7in x 6½in.

7/6 Post 2/6.

COMMUNICATION RECEIVERS MARCONI B38

6, 10, 20 Meters.
6V D.C. 240V A.C. operation,
New condition,

£27/10/-

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Please. No Mail Orders for these.

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522 Genemotors	17/6
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OUR COMPLETE RANGE

RADIO — TV — GADGETS — TAPE RECORDING —
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Price 48/- (N.Z. 38/6)

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DO BIRDS FLY BY THE STARS?

(Continued from Page 19)

Attention has also been drawn to the ea with pigmented borders which is und in many migratory birds.

It has been suggested that this has striking resemblance to the artificial orizon which is used in aircraft.

Now, while it has been fairly well tablished that birds find their direcon by the sun, what about the birds hich migrate only at night time.

This question brings us back to the rd mentioned earlier, namely the arbler. It has been proved that these irds can orientate themselves by the n but, as they fly mainly at night, ere must be something else which ables them to find their way. This as been proved to be the stars.

Many birds "follow the leader" in eir migrations but the warbler and hitethroat fly always on their own. hey find their way individually to their estination thousands of miles away. oung birds or old birds, they do not ave to be taught where to go.

Experiments carried out by scientists ho kept the birds enclosed in cages here they could see nothing of the outde world and where the temperature as controlled to a perpetual spring or ummer brought some surprising reults.

In the autumn the birds became restss. They flew about their cage night fter night for weeks without rest. In act the period of restlessness was xactly the time the birds would have aken to fly to Africa when migrating.

They would then settle down, taking heir normal resting periods, only to beome restless again in the spring at the ime when they would begin to fly back gain from Africa to Europe.

SKY MADE VISIBLE

An opening was then made in the top f the cages so that the birds could see portion of the sky to the exclusion f everything else.

When the usual migration period rived the birds became restless and in ddition orientated themselves in a certain direction. This position was maintained even though the perches were evolved under them.

The direction in which the birds pointd themselves was exactly the direction hey would have flown if they were free o migrate.

When the portion of the sky shown o the bird was covered with cloud the ird lost sense of direction.

The warbler was then put in a cage n a planetarium. When no stars were hown on the "sky" of the planetarium he bird did not orientate himself.

On the other hand, when the planetarium showed the sky, as it would ppear in the bird's "home town," he would immediately face in the proper irection for Africa.

To test the theory still further the ky of the planetarium was gradually hifted about so that it would appear as t was in more southern latitudes. The ird gradually moved with the sky, adjusting its position exactly at all latitudes ested so that it faced in the right direction to reach Africa.

It must be remembered that the bird ested had never migrated, having been reared in captivity from the egg.

It therefore had never learnt by experience and all its behaviour in the planetarium was directed entirely by an inborn instinct, which has provided a wondrous mechanism for using the stars for guidance.

When testing the bird for its reaction to apparent changes in longitude, it was found that whatever position the stars occupied the bird would hesitate during a minute of confusion and then take off in the direction of its normal migration starting place, Germany. It was able to correct the displacement of the stars and head unerringly in the right direction.

These birds do not, of course, rely solely on the stars to guide them to their distant home. They, like other birds, guide themselves by the sun during the day time and, in the case of more experienced travellers, by topographical features of the land during times when the sun is obscured.

At night they seem to travel entirely by the stars and during those times when the sky is overcast they may lose direction and be influenced by the light from lighthouses, ships and even towns and large cities.

The warblers travel more than 100 miles in one night. They travel alone, never in a flock.

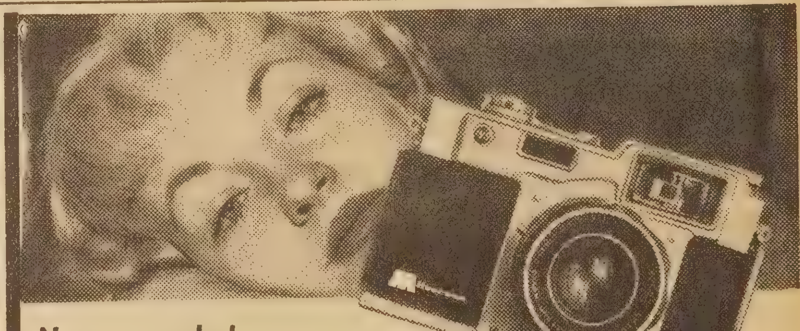
Whilst it has been proved beyond doubt that birds guide themselves by the sun and stars, the actual mechanism of the internal chronometer which enables the bird to estimate time differences has not yet been found.

INITIAL STIMULUS?

There has to be some initial stimulus to the bird which will touch off its migratory instinct. This would at the moment appear to be the changes in the length of the day brought about by seasonal changes in the position of the sun and the inclination of the sun-arc.

The purpose of migration is something upon which to ponder. It would appear that its purpose is to flee from cold winters where food may be scarce and also to take advantage of the longer days, during which more food can be collected for the young birds.

It may be one way nature has for the perpetuation of the species. Whatever the reason the migration of birds is a very wonderful thing which provides us with the lesson that not only man, with all his brains and gadgets, can perform stupendous feats of flight and navigation.



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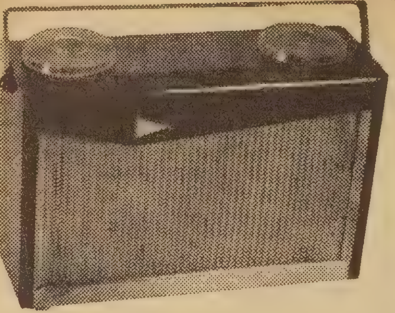

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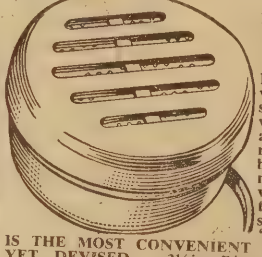

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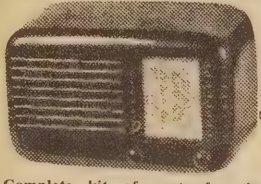

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6K8G	9/6
6SJ7GT	9/6
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1C7G	5/
1K5G	2/6
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1L5	9/6
6AC7	2/6
6C8G	7/6
6SS7	8/6
6H6	2/6
6H6GT	2/6
6K7GT	7/9
6U7G	6/6
6J7G	5/
7C7	3/6
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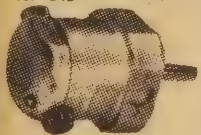

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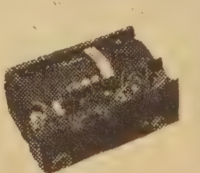

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10	▨	▨	▨	-	1.0	10	100	1000	10000	0.1	1.0	10
11	▨			-	1.1	11	110	1100	11000	0.11	1.1	11
12	▨	▨		-	1.2	12	120	1200	12000	0.12	1.2	12
13	▨			-	1.3	13	130	1300	13000	0.13	1.3	13
15	▨	▨	▨	-	1.5	15	150	1500	15000	0.15	1.5	15
16	▨			-	1.6	16	160	1600	16000	0.16	1.6	16
18	▨	▨		-	1.8	18	180	1800	18000	0.18	1.8	18
20	▨			-	2.0	20	200	2000	20000	0.20	2.0	20
22	▨	▨	▨	-	2.2	22	220	2200	22000	0.22	2.2	22
24	▨			0.24	2.4	24	240	2400	24000	0.24	2.4	24
27	▨	▨		0.27	2.7	27	270	2700	27000	0.27	2.7	27
30	▨			0.30	3.0	30	300	3000	30000	0.30	3.0	30
33	▨	▨	▨	0.33	3.3	33	330	3300	33000	0.33	3.3	33
36	▨			0.36	3.6	36	360	3600	36000	0.36	3.6	36
39	▨	▨		0.39	3.9	39	390	3900	39000	0.39	3.9	39
43	▨			0.43	4.3	43	430	4300	43000	0.43	4.3	43
47	▨	▨	▨	0.47	4.7	47	470	4700	47000	0.47	4.7	47
51	▨			0.51	5.1	51	510	5100	51000	0.51	5.1	51
56	▨	▨		0.56	5.6	56	560	5600	56000	0.56	5.6	56
62	▨			0.62	6.2	62	620	6200	62000	0.62	6.2	62
68	▨	▨	▨	0.68	6.8	68	680	6800	68000	0.68	6.8	68
75	▨			0.75	7.5	75	750	7500	75000	0.75	7.5	75
82	▨	▨		0.82	8.2	82	820	8200	82000	0.82	8.2	82
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IRC Type	Rating at 40° C. Ambient	Length	Diameter	Lead Length	Lead Diameter	Rated Voltage	Minimum Resistance	Maximum Resistance
BTS	½ watt	13/32"	⅛"	1½" + or — ⅛"	.032"	350V	10 ohms	22 meg.
BTA	1 watt	23/32"	¼"	1½" + or — ⅛"	.040"	500V	10 ohms	22 meg.
BTB	2 watt	1¼"	¼"	1½" + or — ⅛"	.043"	500V	*300 ohms	22 meg.

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ANSWERS TO CORRESPONDENTS

R.A.K. (Kingswood, S.A.) writes to congratulate s on an interesting magazine and to suggest that e publish a review of every TV set on the Ausralian market. He also would like to see a escription of all the makes and types of picure tubes on the Australian market.

A. Thanks for the kind remarks R.A.K. and e hope the magazine will continue to prove inresting and helpful. We appreciate the thought ehind your suggestion concerning the review of V sets but we regret that such a scheme would e completely impractical. It would involve far oo much time, for one thing, and time is someing very precious to us these days. The need for e picture tube data is rather more obscure, but is can be obtained without much difficulty on pplication to the various valve manufacturers, or om valve data books available at the larger bookalls.

R.S. (Curl Curl, N.S.W.) wants to know if the 7 Watt and 25 Watt Amplifiers of May and ovember, 1958, respectively would be suitable for se with electric guitars, or what other circuits ight be available.

A. A Guitar Amplifier was described in Decemer, 1954, and reprints of the circuit are available rough our postal service. The other two amplirs could be used, but we have not tried them this role and could not forecast their perrmance in conjunction with your particular units.

No name, no address **(Goolga, N.S.W.).** We reret we cannot reply to you direct, since you have ot included either name or address. The KF3 alve is a very old type, and we doubt if there any direct equivalent available. The best eople to advise you would be the makers, probly Philips or Mullard.

G.W. (Hornsby, N.S.W.) writes to say that his transistor receiver works well with crystal headhones except that there is a whistle in the outut. He can cure the whistle by connecting a pair f 3,000 ohm headphones in parallel wih the ystal phones but naturally does not want to ave two pairs of phones attached to the set.

A. The receiver would not normally operate ith a pair of crystal phones substituted for the agnetic phones and there would be a possibility f damaging the crystal units with this connection. nless you have confused the normal beat note hich results when a station beats with the oscilting detector, we cannot offer a ready explanaon for the whistle. However, if you wish to se crystal headphones with any of the small transtor receivers, the correct procedure is to subitute a choke for the magnetic phones in the rcuit, connect a 0.1 uF capacitor from the colctor of the transistor to one side of the crystal hones and the other side of the phones to earth. o avoid the possibility of a charge building up, is a good idea to connect a resistor across the hones. A suitable value is 0.47 meg. or thereouts. The characteristics of the choke are not o critical for ordinary applications and it would e satisfactory to use the primary winding of a nall speaker transformer or one of the windings f an old-fashioned intervalve audio transformer.

There is just a possibility that equivalent capacity f the phones between collector and ground is ausing the detector to squeal. We may have an pportunity to try some tests with our laboratory odel before too long when we will pass the reilts on to readers.

A.W.L. (Mitchelton, Qld.) is anxious that we ould describe a fully transistorised car-radiom-portable.

A. We have serious doubts about the praccability of such sets using the components which re as yet currently and cheaply available. In few more months, the position may be a lot etter. Basically, the trouble is that the pickup om a car aerial is lower than a loopstick, fter allowing for the losses in the connecting able. It also varies widely as the car moves long and the overall result is likely to be very isappointing. A really successful car radio needs fully effective RF stage, a very flat AVC aracteristic and high overall gain.

G.W.B. (Geelong, Vic.) is another reader inrested in radio control for models and wants know when we intend to describe a transtorised circuit for such a project.

A. We have never made any firm promises out radio control circuits, G.W.B., although e have expressed the hope that we could get ound to something along these lines. However, ansistorised circuits have yet to be fully develop1 and are not necessarily better than valve ciruits at this stage.

L.O.S. (Unley, S.A.) wants to know if we ave ever described a TV field strength meter of e portable type.

A. No, L.O.S., we have not described this vice so far and, frankly, there does not seem be a very great demand for these devices. In dition, a unit to be worthwhile must have a gh order of sensitivity, otherwise it will fail in inge areas—the place where it is most needed. any simple designs fall far short of this requireent. Nevertheless, we will keep this idea in ind.

J.B. (Mackay, Qld.) is interested in the Karlson type speaker enclosure and wants to know if we can supply any information.

A. We have never featured this type enclosure in the magazine, J.B., and we doubt if it has anything to offer over the conventional vented enclosure. However, we understand the Mullard organisation published some data on it for the benefit of those who might be interested, and we suggest you may care to contact them direct.

R.B.J. (Balgowlah Heights, N.S.W.) has built the three transistor mantel set of March, 1959, but is not getting the results he expected.

A. If the presence of the trimmer across the tuned circuit prevents reception of all signals, we would strongly suspect that the trimmer was faulty, probably shorted. This should not be hard to confirm, either by test or substitution. In regard to the set's performance generally, it is unfortunate that you have been able to give us so little information, particularly whether the regeneration is working correctly and on which the set depends for its performance. If you care to let us have further details we will be happy to offer any help we can.

L.C.L. (Burwood, Vic.) writes to tell of his experiences with the improved VTVM of December, 1958, and to tell of the circuit changes he found necessary.

A. Unfortunately, you fail to explain the manner in which the original circuit failed to perform. Similarly, there is no mention of the manner in which the voltages you mention were measured, and in particular the type of meter used. For this reason, they may mean very little. In the circumstances, we feel that the most likely explanation is a circuit or component fault which has been overlooked, and the changed circuitry is merely an attempt to correct one fault with another. The original version of this instrument showed no symptoms which would suggest the need for the changes indicated, and was made with typical components of normal tolerance.

S.L.M. (Picton, N.S.W.) writes to advise of a change of address and to detail some of his recent experiments with a Bendix RA10DA.

A. Your change of address has been forwarded to the appropriate department and duly noted. Your comments concerning the Bendix are interesting but, as we have not had an opportunity to conduct similiar experiments ourselves, we cannot offer much advice concerning this particular circuit. However, it would appear that you will have a useful receiver when the motorboating problem has been solved.

W.M. (Henry Head, N.S.W.) says he has built the "Transporta Seven" and found that it would work with an OC70 in the mixer stage.

A. Thanks for your letter and you have no need to fear that you are a candidate for "the Bin," as you put it. Transistors are made to have a certain minimum frequency characteristic, but there is nothing to say that individual samples will not be a lot better than expectations. If your set works well the way you have it, by all means leave it that way.

No Name (North Strathfield, N.S.W.) asks for the circuits of a simple amplifier for a record player and also for the circuit of a two-valve receiver operating from six volts.

A. There are a number of mains powered amplifiers in our files which would probably suit your record player and also one or two designed to operate from batteries. If you would let us know we will try to choose the one best suited to your requirements. We can't recall a two valve set designed to operate from a six-volt battery only. Normally, a vibrator power supply would be required for such a set. Rather than go to the expense of the vibrator supply, we would be inclined to use a high-tension battery. We would draw your attention to the usual conditions of the 2/ query service as set out on these pages.

M.J.D'E. (Blackburn, Vic.) would like to know if we have published a receiver using valve types 5Y3, 6V6, EDF2-G and 6J8.

A. Yes, M.J.D'E., the Little General for 1946 featured in the January, 1946, issue of R. and H. would suit your requirements, although it is a straight-out superhet. Circuit reprints, etc., may be obtained in the usual manner through the query service.

I.M. (Hamilton, N.Z.) refers to the article on the DC to DC converter which appeared in the August issue. This mentions that some of the transformer windings for the converter are carried out in a bifilar manner but does not understand what is meant by this.

A. The bifilar idea is used for winding noninductive resistors as the book you have suggests. By twisting a pair of wires throughout their length, the mutual inductance between them will be very high. If a current is passed down one wire and back through the other, the magnetic field of one will largely cancel the magnetic field of the other and the resultant system will have little inductance.

A twisted pair of wires, extended as necessary, may be used as a transformer winding. In this case, instead of joining the two wires at the same end of the combined length, one is taken and joined with the other at the opposite end. This join is the centre tap of a winding which will have low leakage inductance between the two halves. Similarly, one wire can be used as the primary of a transformer and the other as a secondary. Leakage inductance between primary and secondary will then be low. The twisting is costly and takes up a good deal of space in the transformer so that it is more usual to simply place the two wires side by side. Rectifiers types 1N1763, OA210 or 1N1764 in a bridge circuit should serve for the supply you have in mind. The last is more expensive, but will handle up to at least 400v.

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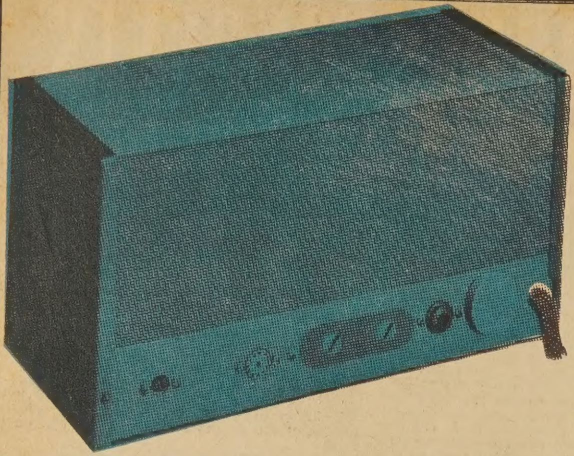

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WORLD'S LOUDEST NOISE

(Continued from Page 15)

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ADJUSTING YOUR TELEVISION RECEIVER

(Continued from Page 75)

Having set the sound trap by inspecon of the screen, the next step is to djust the input transformer to the sound mplifier and the ratio detector transormer.

The suggested method is to break the arth connection for one of the 10K emodulator diode load resistors and inert a 1-milliamp meter with a polarity uch that it reads normally when the eceiver is tuned to a station.

In observing the reading, it is necesary to remember that this test point is receded by a limiting amplifier and hat peaks of adjustment may be aborbed or even inverted by the limiting ction.

The effect of adjustments will be much ess ambiguous, therefore, if the input ignal is deliberately kept down in trength as by:

(1) Shorting the aerial terminals across;

(2) Biasing the IF amplifier to —4.5 olts or thereabouts;

(3) Turning the Fine Tune control or minimum sound level (as read on the neter) on Channel 7 or 9.

By restricting the diode current reading by one or more of these means to).1 milliamp or less, the effect of adjustments can more readily be seen. Adjust the core of the transformer feeding he 6AU6 amplifier for maximum diode current, running through the winding to make sure that there are two response points. Either one can be used, since t is a single winding.

Now adjust the core of the ratio transformer primary winding — the bottom core in the Q-Plus transformer—favouring the outer position if there happens o be two and adjusting for maximum diode current.

Next adjust the secondary core for maximum diode current, re-checking both primary and secondary when this has been done.

While the ratio detector should now be very close to optimum adjustment, it is a good idea to check for balance, if possible, with a VTVM.

Set the VTVM at mid-scale with the Zero Adjust on the 3-volt DC range. Clip the test leads between chassis and the audio take-off point from the ratio detector. Adjust the transformer secondary slug for exact balance so that no voltage is evident with respect to chassis.

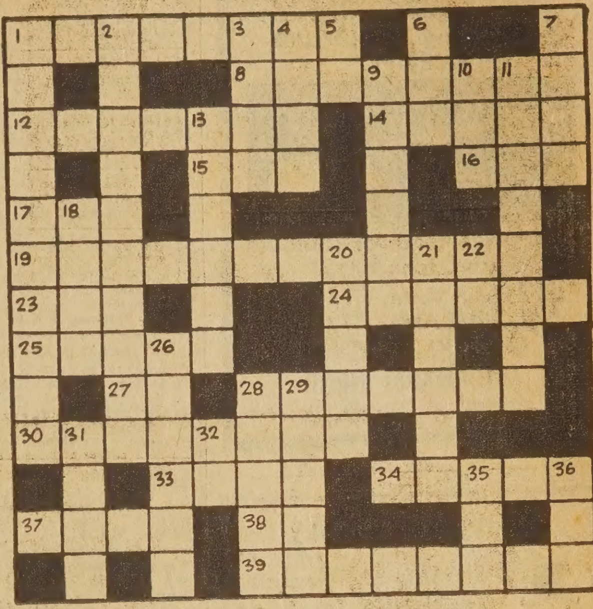
If no VTVM is available, the slug can be set quite critically by a listening test. Choose a time when a test pattern is being radiated, preferably with no sound or relatively low level sound. Turn up the audio gain and listen carefully for any suggestion of 50-cycle frame buzz.

Adjust the ratio transformer secondary core for minimum buzz level.

THE R., TV & H. CROSSWORD No. 66

ACROSS

1. Control on a TV set.
8. Device for hearing.
12. Set of interconnected conductors.
14. A theatrical entertainment.
15. Hawaiian dish.
16. Unit of current.
17. Self.
19. Insulator.
23. Tool for cutting.
24. A division of the year.
25. Best in Society.
27. Doctor (abbrev.).
28. Leaps.
30. Famous piano maker.
33. Is indebted to.
34. Valve elements.
37. Accustomed.
38. Exclamation.
39. Extended in same direction and equidistant.



DOWN

1. Capacitors.
2. Throughout a country.
3. Prefix pertaining to air.
4. South American monkey.
5. Traction (abbrev.).
6. This or that female.
7. To look slyly.
9. Son of a King.
10. Ovum (pl.).
11. Many.
13. To resist.
18. The final purpose.
20. Exorbitant interest.
21. One who converts raw hides into leather.
22. Out size (abbrev.).
26. Three element valve.
28. Rub over with a broom.
29. Turkish official of high rank.
31. Examination.
32. Compass Point.
35. Sick.
36. Girl's name.

Solution and further crossword next month

SILICON RECTIFIERS

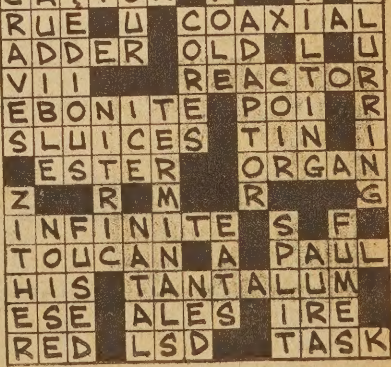
(Continued from Page 85)

Zener conduction region by the current-limiting resistance, R.

Small changes in the rectifier current produce large changes in the collector output resistance of the transistor, as a result of the latter's high current amplification factor.

Since the collector-emitter resistance shunts the DC output terminals, this resistance variation has a regulating effect on the output voltage of the circuit.

Last month's solution



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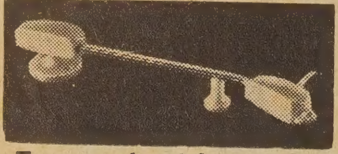

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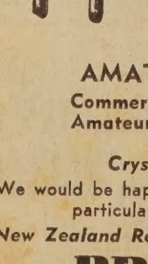

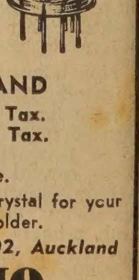

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